Printed Page:- 05 **Subject Code**:- AMIAS0203

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

SEM:II CARRY OVER THEORY EXAMINATION -AUGUST 2023

Subject: Engineering Mathematics-II

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. Degree and order of the differential equation $\sqrt{((dy/dx)^2+3y)} = (d^2y)/(dx^2)$ is (CO1) 1

(a) **Ord = 2, Deg = 2**

(b) **Ord = 2, Deg = 1**

(c) **Ord = 1, Deg = 2**

(d) **Ord = 1, Deg = 1**

1-b. The P.I. of the differential equation $(D^2 + 4)y = Cos\ 2x$ (CO1) 1

(a) $(x/4)\ \cos 2x$

(b) $(x/4)\ \sin 2x$

(c) $-(x/4)\ \sin 2x$

(d) $x\ \cos 2x$

1-c. The coefficient a_0 in a Fourier series for the function $f(x) = x + x^3$ in the interval $-\pi < x < \pi$ is (CO2) 1

(a) π

(b) 2π

(c) 0

(d) none of these

1-d. The series $\sum_{n=1}^{\infty} u_n$ of positive terms is divergent if $\lim_{n\to\infty} n\left(\frac{u_n}{u_{n+1}}-1\right)$ is 1

(a) < 1

(b) > 1

(c) = 1

(d) none of these

1-e. Laplace transform of $f(t) = 7e^{-2t}$ is (CO3) 1

(a) $\frac{7}{s-2}$

(b) $\frac{1}{s+2}$

(c) $\frac{7}{s+2}$

(d) $\frac{1}{s-2}$

1-f. Laplace transform of t^3e^{-3t} is (CO3) 1

(a) $\frac{6}{(s+3)^4}$

(b) $\frac{6}{(s-3)^4}$

(c) $\frac{3}{(s-3)^4}$

(d) None of these

1-g. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then div$\vec{r}$ equal to (CO4) 1

(a) 4

(b) 8

(c) 5

(d) 3

1-h. Gauss Divergence theorem represents relation between (CO4) 1

(a) Line and surface integrals

(b) Volume and work done

(c) Surface and line integrals

(d) Surface and Volume integrals

1-i. Pointing towards a person, Alok said, "the person is my grandfather's only 1

daughter's daughter's uncle". How is the person related to Alok? (CO5)

(a) Father

(b) Uncle

(c) Brother

(d) None of these

1-j. A person starts towards South direction. Which of the following order of direction will lead him to East direction? (CO5) 1

(a) Right, Right, Right

(b) Left, Left, Left

(c) Left, Right, Right

(d) Right, Left, Right

2. Attempt all parts:-

2.a. Find the Particular integral of the differential equation $(4D^2 + 4D - 3)y = e^{2x}$ (CO1) 2

2.b. Discuss the convergence of the sequence $\{a_n\}$ where $a_n = \left(\frac{n+1}{n}\right)$. (CO2) 2

2.c. Find the Laplace transform of the function $F(t) = (t-1)^2 u(t-1)$. (CO3) 2

2.d. Find the unit normal of the surface $z = x^2 + y^2$ at $(-1, -2, 5)$. (CO4) 2

2.e. ₹ 385 were divided among P, Q and R in such a way that P had ₹ 20 more than Q and R had ₹ 15 more than P. How much was R's share? (CO5) 2

SECTION B **30**

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

3-a. Solve the differential equation $(D-1)^2 y = xe^x \sin x.$ (CO1) 6

3-b. Solve $\frac{dx}{dt} + \frac{dy}{dt} + 3x = \sin t, \frac{dx}{dt} + y = \cos t$. (CO1) 6

3-c. Test the convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \frac{7}{4.5.6} + \ldots\ldots\ldots$ (CO2) 6

3-d. Expand $f(x) = \pi x - x^2$ as a Fourier half range sine series in $0 < x < \pi$ upto the first three terms. (CO2) 6

3.e. Find the Laplace Transform of the function $F(t) = \int_0^t te^{-t}\sin 4t \, dt$. (CO3) 6

3.f. Evaluate 6

$\int\int_S \vec{A}.\hat{n}dS$, where $\vec{A} = (x+y^2)\hat{i} - 2x\hat{j} + 2yz\hat{k}$ and S is the surface of the plane 2x + y + 2z = 6 in the first octant. (CO4)

3.g. (i) In 60 liters beverage, the ratio of syrup and water is 3:7. If the ratio of the syrup and water is to be made 2:5, what is the amount of water to be further added? 6

(ii) A container has 80 L of milk, from this container 8 L of milk was taken out and replaced by water. The process was further repeated twice. What is the value of milk in the container after that? (CO5)

SECTION C **50**

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

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

$\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} + 4x^2y = x^4$. (CO1)

4-b. Solve the differential equations by method of variation of parameters 10

$y'' - y = \frac{2}{1+e^x}$. (CO1)

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

5-a. Test the convergence of the series 10

$x + \frac{1.x^3}{2.3} + \frac{1.3.x^5}{2.4.5} + \frac{1.3.5\,x^3}{2.4.6.7} + \ldots\ldots\ldots$ (CO2)

5-b. 10

Obtain the Fourier Series to represent the function $f(x) = x\cos x$ in the interval $-\pi < x < \pi$. (CO2)

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

6-a. Solve the following differential equation by using Laplace Transformation 10

$y'' + 4y' + 8y = \sin t$, where $y(0) = 1$, $y'(0) = 0$. (CO3)

6-b. Find the inverse Laplace transform of 10

$L^{-1}\left\{\frac{s}{(s^2+1)(s^2+4)}\right\}$. (CO3)

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

7-a. 10

Evaluate the Green's Theorem $\int_C (e^{-x}\sin y\,dx + e^{-x}\cos y\,dy)$, where C is the rectangle with vertices $(0,0), (\pi,0), (\pi,\pi/2), (0,\pi/2)$ and hence verify

Green's Theorem. (CO4)

7-b. Evaluate $\int\int_S \vec{A}.\hat{n}dS$, where $\vec{A} = z\hat{i} + x\hat{j} - 3y^2z\hat{k}$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between z=0 and z=5. 10

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

8-a. (i) Prerna invested Rs x for 6 months, Ankita Rs 2400 for 10 months and Pavneet Rs 3900 for 8 months. If Ankita got Rs 6000 out of a total profit of Rs 19,200, then what is the money? 10

(ii) Trisha and Misha invested Rs 3500 and Rs 3000 in a business. After 7 months both added Rs 500 to their investments. If after a year the difference in their shares of profit is Rs 1140,find the total profit at the end of year? (CO5)

8-b. (i)Sharad started from home for his work and drove 50 km towards the east, then took a right turn and drove another 30 km. He again took a left turn and drove 30 km in that direction. Then, he turned to his right and drove 30 km to reach his final destination. What is the shortest distance between Sharad's home to his office? 10

(ii) To reach his school, Ritesh started from his house and walked 10 km towards the south. He then took a right turn and walked 5 km and finally took a left turn. After walking for 7 km, he finally reached his school. In which direction is Ritesh's house from his school? (CO5)