Printed Page:-04 **Subject Code:- AAS0203 /AASH0203**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2024 - 2025)

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. The P.I. of the differential equation $(D^2 + 4)y = \sin 3x$ is (CO1,K2) 1

(a) $(-1/10)\sin 3x$

(b) $(-1/5)\sin 3x$

(c) $(1/5)\sin 3x$

(d) None of these

1-b. All roots of the auxiliary equation of the differential equation $(D^2 - 6D + 25)^2 y = 0$ are (CO1,K2) 1

(a) $3 \pm 4i, 3 \pm 4i$

(b) $3 \pm i, 3 \pm i$

(c) $3 \pm 2i, 3 \pm 2i$

(d) $3 - 4i, 3 + 2i$

1-c. The Series $1 + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{4}} + \frac{1}{\sqrt{5}} + \ldots\ldots\ldots$ is (CO2,K1) 1

(a) convergent

(b) oscillatory

(c) divergent

(d) none of these

1-d. The coefficient a_n in a Fourier series for the function $f(x) = x\cos x$ in the interval $-\pi < x < \pi$ is (CO2,K1) 1

(a) π
(b) 2π
(c) 1
(d) 0

1-e. Laplace transform of $f(t) = 7e^{-2t}$ is (CO3,K2) 1

(a) $\frac{7}{s-2}$
(b) $\frac{1}{s+2}$
(c) $\frac{7}{s+2}$
(d) $\frac{1}{s-2}$

1-f. Inverse Laplace of $f(s) = \frac{1}{s+3}$ is (CO3,K2) 1

(a) $\frac{1}{3}e^{3t}$
(b) $-\frac{1}{3}e^{3t}$
(c) $\frac{1}{e^{3t}}$
(d) e^{3t}

1-g. If $\vec{r} = x\,\hat{i} + y\,\hat{j} + z\,\hat{k}$, then div $\vec{r}$ equal to (CO4,K2) 1

(a) 4
(b) 8
(c) 5
(d) 3

1-h. If $\vec{F}$ denotes velocity of fluid, then $\oint_c \vec{F}.\vec{dr}$, represents (CO4,K1) 1

(a) Work done
(b) Circulation
(c) flux
(d) None of these

1-i. Find the mean proportional between given two numbers that is 64 and 49 ? (CO5,K2) 1

(a) 45
(b) 52
(c) 54

.

(d) 56

1-j. 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,K2) 1

(a) Brother
(b) Nephew
(c) Uncle
(d) Son-in-law

2. Attempt all parts:-

2.a. Solve the differential equation: $(D^3 - 3D^2 + 4)y = 0.$ (CO1,K2) 2

2.b. Write the statment of Rabbe's test for the series $\sum u_n$ (CO2,K1) 2

2.c. Find Laplace transform of the function $F(t) = \sin^2 3t.$ (CO3,K2) 2

2.d. **Find grad $\emptyset$, where $\emptyset = \log(x^2 + y^2 + z^2)$.** (CO4,K2) 2

2.e. find Anil's present age if After 8 years, Anil will be three times as he was 8 years ago. (CO5,K2) 2

SECTION-B 30

3. Answer any five of the following:-

3.g. (i) A sum of ₹ 350 made up of 110 coins, which are of either ₹ 1 or ₹ 5 denominations. How many coins are of ₹ 5? 6

(ii) a = 2b = 3c = 4d, find the a: b: c: d ? (CO5,K2)

3-a. Solve the differential equation $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$ (CO1,K3) 6

3-b. Solve the differential equation $(D^2 - 2D - 3)y = 2e^{2x} + 10\sin 3x$ given that $y(0) = 2, y'(0) = 4.$ (CO1,K3) 6

3-c. Show that the series $1 + \frac{1}{2^2} + \frac{2^2}{3^2} + \frac{3^2}{4^2} + \ldots\ldots\ldots$ is divergent. (CO2,K3) 6

3-d. **Expand $f(x) = x^2$ as a Fourier half range cosine series in $0 < x < 2$.** (CO2,K3) 6

3.e. Find the Laplace Transform of the function $F(t) = \int_0^t te^{-t}\sin 4t\, dt$. (CO3,K3) 6

3.f. **Find the directional derivative of the function $f = (x^2 + y^2 + z^2)^{-1/2}$ at $(3,1,2)$ in direction of the vector $yz\hat{i} + zx\hat{j} + xy\hat{k}$.** (CO4,K3) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Solve the differential equations by method of variation of parameters $y'' - y = \frac{2}{1+e^x}$. (CO1,K3) 10

4-b. Solve $\frac{dx}{dt} + 2x - 3y = t$, $\frac{dy}{dt} - 3x + 2y = e^{2t}$. (CO1,K3)) 10

5. Answer any one of the following:-

5-a. Obtain the Fourier Series to represent the function $f(x) = x - x^2$ in the interval $-\pi \le x \le \pi$. Hence show that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots = \frac{\pi^2}{12}$. (CO2,K3) 10

5-b. Obtain the Fourier series to represent function $f(x) = x\sin x$ in the interval $0 \le x \le 2\pi$ 10

6. Answer any one of the following:-

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

$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + x = t\,e^{-t}$, Given that $x(0) = 1$, $x'(0) = 2$. (CO3,K3)

6-b. By using Convolution theorem, find $L^{-1}\left\{\frac{s}{(s^2+4)(s^2+9)}\right\}$. (CO3,K3) 10

7. Answer any one of the following:-

7-a. Apply Stokes theorem to evalaute $\int_C (x+y)\,dx + (2x-z)\,dy + (y+z)\,dz$, where C is the boundary of the triangle with vertices (2,0,0), (0,3,0), (0,0,6). (CO4,K3) 10

7-b. Verify Divergence theorem for $\vec{F} = (x^2 - yz)\,\hat{i} - (y^2 - ZX)\hat{j} + (z^2 - xy)\,\hat{k}$ taken over the rectangular parallelopiped $0 \le x \le a$, $0 \le y \le b$, $0 \le z \le c$. (CO4,K3) 10

8. Answer any one of the following:-

8-a. (i) Vinod starts from his house and travels 4 km in East direction after that he turns towards left and moves 4 km. Finally, he turns towards left and moves 4 km. At what distance and in which direction he finally stands from his starting point? 10

(ii) A person moves 15 km in East direction then turns towards North and moves 4 km. From here he turns towards West and travels 12 km. How far and in which direction is he from his starting point? (CO5,K3)

8-b. (i) A father is twice as old as his daughter. If 20 years ago, the age of the father was 10 times the age of the daughter, what is the present age of the father? 10

(ii) Arun is 2 years older than Bharat who is twice as old as Charat. If the total of the ages of Arun, Bharat and Charat be 27, then how old is Bharat? (CO5,K3)