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Subject Code:- AAS0203

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: II - THEORY EXAMINATION (2020 - 2021)

Subject: Engineering Mathematics-II

Time: 03:00 Hours

Max. Marks: 100

General Instructions:

- All questions are compulsory. It comprises of three Sections A, B and C.
- Section A - Question No- 1 is objective type question carrying 1 mark each & Question No- 2 is Very short type questions carrying 2 marks each.
- Section B - Question No- 3 is Long answer type - 1 questions carrying 6 marks each.
- Section C - Question No- 4 to 8 are Long answer type -2 questions carrying 10 marks each.

SECTION A 20

1. Attempt all parts:-

1-a. The P.I. of the differential equation $(D^2 + 1)y = \sin x$ CO 1 1

1. $(-x/2)\cos x$
2. $(x/2)\cos x$
3. $(x/2)\sin x$
4. $(x/4)\sin x$

1-b. *The value for* $\frac{1}{D-2}\ Sin2x$ CO 1 1

1. $e^{2x}\int e^{2x}\sin 2x\,dx$
2. $e^{2x}\int e^{-2x}\sin 2x\,dx$
3. $e^{-2x}\int e^{2x}\sin 2x\,dx$
4. None of these

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

1. convergent
2. oscillatory
3. divergent
4. none of these

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

$-\pi < x < \pi$ is

1. π
2. 2π

3. 0
4. none of these

1-e. Laplace Transform of the function $F(t) = \cos h\ 3t$ is CO 3 1

1. $\frac{s}{s^2-9}$
2. $\frac{3}{s^2+9}$
3. $\frac{1}{s^2+9}$
4. $\frac{s}{s^2+9}$

1-f. Inverse Laplace of the function $f(s) = \left[\frac{-5}{s^2+s-6}\right]$ is CO 3 1

1. $e^{3t}-e^{2t}$
2. $e^{3t}+e^{2t}$
3. $e^{3t}+e^{t}$
4. None of these

1 Find the unit normal at the surface $z = x^2+y^2$ at the point $(1,2,5)$ is (CO4) 1

1. $2x+4y$
2. $2x\,\hat{i}+4y\,\hat{j}$
3. $\frac{-2x\,\hat{i}-4y\,\hat{j}+\hat{k}}{\sqrt{21}}$
4. None of these

1 If div $\vec{F} = 0$ every where in some region R of space, then $\vec{V}$ is called (CO4) 1

1. Irrotational
2. Rotational
3. Solenoidal
4. None of these

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

1. 45
2. 52
3. 54
4. 56

1-j. Find the simple interest on Rs 500 for 5 years at 10% per annum. (CO5) 1

1. Rs 500
2. Rs 125
3. Rs 250
4. Rs 350

2. Attempt all parts:-

2.a. Find the complementary function of the second order linear differential equation $x^2y'' + xy' + y = \log x^2$ CO 1 — 2

2.b. Write the statment of Rabbe's test for the series $\sum u_n$ CO-2 — 2

2.c. Find Laplace transform of the function $F(t) = \frac{\cos at - \cos bt}{t}$. CO 3 — 2

2.d. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then show that grad $(r) = \frac{\vec{r}}{r}$ (CO4) — 2

2.e. After 2 years, the age of Karthi is 2 times the present age of Silambu. Preethi is 8 years elder than Silambu. Find the present age of Karthi, if the present age of Preethi is 23 years? (CO5) — 2

SECTION B — 30

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

3-a. Solve : $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = x^2e^{-x}\cos x.$ CO 1 — 6

3-b. Solve the differential equation $xy'' - y' + (1-x)y = x^2e^{-x}$, given that $y = e^x$ is a part of CF. CO 1 — 6

3-c. Test the convergence of the series $\sum_{n=1}^{\infty}\left[(n^4+1)^{\frac{1}{4}} - n\right]$ CO – 2 — 6

3-d. Test the convergence of the series, $\frac{x}{1.2} + \frac{x^2}{2.3} + \frac{x^3}{3.4} + \frac{x^4}{4.5} + \ldots\ldots\ldots$ CO – 2 — 6

3-e. Find the Laplace Transform of the function $\int_0^t \frac{e^{-4u}\sin 3u}{u}du$. CO 3 — 6

3-f. Show that $\vec{F} = (\sin y + z)\hat{i} + (x\cos y - z)\hat{j} + (x - y)\hat{k}$, is irrotational. Also find the Scalar potential. (CO4) 6

3-g. (i) The respective ratio of the present ages of a mother and daughter is 7: 1. Four years ago the respective ratio of their ages was 19:1. What will be the mother's age four years from now? 6

(ii) The ages of Aarzoo and Arnav are in the ratio of 11:13 respectively. After 7 years the ratio of their ages will be 20:23. What is the difference in years between their ages? (CO5)

SECTION C 50

4. Answer any one of the following-

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

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

4-b. Solve $\frac{dx}{dt} + 2x - 3y = t,\ \frac{dy}{dt} - 3x + 2y = e^{2t}.$ 10 CO 1

5. Answer any one of the following-

5-a. Obtain the Fourier series for the function $f(x) = \frac{1}{4}(\pi - x)^2$ in the interval $0 \le x \le 2\pi$. CO – 2 10

Hence obtain the following relations:

(i) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots\ldots = \frac{\pi^2}{6}$ (ii) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots = \frac{\pi^2}{12}$

(iii) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$

5-b. Obtain the Fourier series for the function $f(x) = \begin{cases} 0, & -\pi \le x \le 0 \\ \sin x, & 0 \le x \le \pi \end{cases}$. (CO2) 10

Hence show that $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \ldots\ldots\ldots\ldots = \frac{1}{2}$

6. Answer any one of the following-

6 Find the Laplace transform of the rectified semi wave function defined by 10

$$f(t) = \begin{cases} \sin \omega t & 0 \le t < \frac{\pi}{\omega} \\ 0 & \frac{\pi}{\omega} \le t < \frac{2\pi}{\omega} \end{cases}.$$ CO 3

6 Solve the following differential equation by using Laplace transformation 10

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + x = t\,e^{-t},\ \text{Given that } x(0) = 1,\ x'(0) = 2$$ CO 3

7. Answer any one of the following-

7-a. Evaluate $\oint_C \vec{F}.d\vec{r}$, by stokes theorem, where $\vec{F} = y^2\hat{i} + x^2\hat{j} - (x+z)\hat{k}$ and C is the boundary of the triangle with vert 10

7-b. Find the directional derivative of $\vec{V}^2$ where $\vec{V} = xy^2\hat{i} + zy^2\hat{j} + xz^2\hat{k}$ at the point $(2,0,3)$ in the direction of the outwa 10

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

8-a. (i) Amit started a business by investing ₹ 30,000. Rahul joined the business after some time and invested ₹ 20,000. At the end of the year, profit was divided in the ratio of 2: 1. After how many months did Rahul join the business? 10

(ii) The monthly income of Komal and Asha are in the ratio of 4: 3. Their monthly expenses are in the ratio of 3: 2. However both saves ₹ 600 per month. What is their total monthly income? (CO5)

8-b. (i) I was facing East from where I turned to my left and walked 12 feet then I turned towards right and walked 6 feet. After that I walked 6 feet in South direction and at last walked 6 feet in the West. Then, in which direction am I standing from the original point? 10

(ii) Radha left her home in the morning and walked towards the East for 4 km and then took a 90^0 anticlockwise turn and walked for another 3 km to reach her school. On the same day in the morning, her brother Raman left the same house and walked towards the South for 6 km and took a right turn and walked for 8 km to reach his college. What is the shortest distance between Radha's school and Raman's college? (CO5)