**Printed Page:-04** Subject Code:- BAS0203 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. C-2021 20 **SECTION-A** 1. Attempt all parts:-1-a. The value for  $\frac{1}{D-2} \sin 2x$  is : (CO1, K2)

1

1

- $e^{2x}\int e^{2x} \sin 2x \, dx$ (a) (b)  $e^{2x}\int e^{-2x}\sin 2x \, dx$
- $e^{-2x}\int e^{2x}\sin 2x \, dx$ (c)
- None of these (d)
- The complementary function of the second order linear differential equation 1-b.  $x^2y'' - xy' = 0$  is : (CO1,K1)
  - $c_1 + x c_2$ (a)
  - (b)  $c_1 + x^2 c_2$
  - $\mathbf{c}_1 + \mathbf{e}^{\mathbf{x}} \mathbf{c}_2$ (c)
  - None of these (d)

1-c.

For the series  $\sum_{n=1}^{\infty} u_n \text{ of positive terms the Raabe's test fail if} n \to \infty \left( \frac{u_n}{u_{n+1}} - 1 \right)$ is (CO2,K1) 1

<1 (a)

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- (b) >1
- (c) = 1
- none of these (d)

The coefficient  $a_0$  in a Fourier series for the function  $f(x) = x + x^3$  in the interval 1-d. 1  $-\pi < x < \pi$  is (CO2,K2)

- π (a)
- (b) 2π
- (c) 0
- none of these (d)

1-e.

Inverse Laplace of the function 
$$f(s) = \frac{1}{(s+1)^2}$$
 is (CO3,K1)

1

1

(CO3,K2)

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(a) 
$$te^t$$

- (b)
- (c) te <sup>-t</sup>
- None of these (d)

Laplace transform of  $f(t) = 5e^{2t} + 2is$ 1-f

(a) 
$$\frac{5}{s-2} - \frac{1}{s}$$
  
(b)  $\frac{5}{s-2} + \frac{1}{2s}$   
(c)  $\frac{5}{s-2} + \frac{2}{s}$ 

(d) None of these

1-g. If 
$$\emptyset = 3x^2y - y^3z^2$$
 then grad  $\emptyset$  at the point  $(1, -2, -1)$  is (CO4,K2) 1

- $-12\hat{i}-9\hat{j}-16\hat{k}$ (a)
- $12\hat{i} + 9\hat{j} + 16\hat{k}$ (b)
- $\hat{i} + \hat{j} + \hat{k}$ (c)

1-h.

- (d)  $= (\mathbf{y} + \mathbf{z}) \hat{\mathbf{i}} + (\mathbf{z} + \mathbf{x}) \hat{\mathbf{j}} + (\mathbf{x} + \mathbf{y}) \hat{\mathbf{k}}$ , curl of  $\vec{\mathbf{F}}$  equal to 1 (CO4,K1) If F
  - (a) 0
  - $\hat{i} + \hat{j} + \hat{k}$ (b)
  - (c) 3
  - (d) None of these
- Rs 4200 is divided among Jay, Sanjay and Vijay in the ratio of 2: 4: 6. Find the 1-i. 1 amount received by Sanjay (CO5,K1)
  - ₹1200 (a)
  - ₹1300 (b)

- (c) **₹1400**
- (d) **₹1500**

1-j. If the volume and base area of cuboid are  $144 \text{ m}^3$  and  $18 \text{ m}^2$  respectively. Then height is (CO5,K1)

1

10

- (a) 6 m
- (b) 10 m
- (c) 8 m
- (d) None of these
- 2. Attempt all parts:-

2.a.	Solve the differential equation : $(D^3 - 3D^2 + 4)y = 0$ .(CO1,K1)	2
2.b.	Find the Fourier coefficient ${}^{a_{0}}$ for $f(x) = x^{2} - 2$ in the interval $-2 < x < 2$ . (CO2,K1)	2
2.c.	Find the Laplace transform of the function $F(t) = (t-1)^2 u (t-1)$ . (CO3,K2)	2
2.d.	Show that vector $\vec{V} = (x+3y)\hat{i} + (y-3z)\hat{j} + (x-2z)\hat{k}$ , is solenoidal. (CO4,R	(2)
2.e.	The product of the ages of Asha and Nithi is 540. If twice the age of Asha is more than Nithi's age by 6 years, then find Asha's age? (CO5,K1)	2
<b>SECTIO</b>	<u>DN-B</u>	30
3. Answe	er any <u>five</u> of the following:-	
3-а.	Solve the differential equation: $(D-1)^2 y = xe^x sinx \cdot (CO1, K3)$	6
3-b.	Solve the differential equation: $(D^2 - 2D - 3)y = 2e^{2x} + 10\sin^3 x$ , given that $y(0) = 2$ , $y'(0) = 4$ .(CO1,K2)	6
3-с.	Test the convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \frac{7}{4.5.6} + \dots \dots (CO2, K2)$	6
3-d.	Express sin x as a cosine series in the interval $0 < x < \pi$ . (CO2,K1)	6
3.e.	Evaluate the value of $\int_0^\infty \frac{\cos 6t - \cos 4t}{t} dt$ . (CO 3,K2)	6
3.f.	Find the total work done by a force $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ in moving a point from (0,0) to (a,b) along the rectangle bounded by the lines x=0, x=a, y=0, and y=b. (CO4,K3)	6
3.g.	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,K2)	6
SECTIO	DN-C	50

4. Answer any one of the following:-

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4-a. Solve the differential equations by method of variation of parameters:

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$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = x^3 e^x \cdot (CO1, K2)$$

4-b. Solve the differential equation by reducing it into normal form (removal of first  

$$\frac{d^{2}y}{dr^{2}} - 4x \frac{dy}{dx} + (4x^{2} - 1)y = -3e^{x^{2}} \sin 2x \cdot (CO1, K3)$$
5. Answer any one of the following:-  
5-a.  

$$f(x) = \begin{cases} x, & -\pi < x < 0 \\ -x, & 0 < x < \pi \end{cases}$$
Hence  

$$\frac{1}{x} + \frac{1}{3^{2}} + \frac{1}{3^{2}} + \frac{1}{5^{2}} + \dots = \frac{\pi^{2}}{8} \cdot (CO2, K2)$$
5-b.  
Test the convergence of the series  

$$1 + \frac{x}{2} + \frac{1.3}{2.4}x^{2} + \frac{1.3.5}{2.4.6}x^{2} + \dots = x > 0$$
10  

$$\frac{d^{2}x}{dt^{2}} + 2\frac{dx}{dt} + 5x = e^{-t} \sin t, \quad Given that x = 0, \frac{dx}{dt} = 1 \text{ at } t = 0.$$
(CO3, K3)  
6-b. Use Convolution theorem to evaluate: (CO3, K2)  

$$L^{-1}\left\{\frac{s}{(s^{2} + a^{2})(s^{2} + b^{2})}\right\}$$
7. Answer any one of the following:-  
7-a.  

$$\int_{C} (e^{-x}\sin y \, dx + e^{-x}\cos y \, dy), \qquad 10$$
Evaluate the Green's Theorem 
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Answer any one of the following:-  
7-a.  
(CO4, K2)  
7-b. Verify Stoke's theorem for the function  $\vec{F} = x^{2}\hat{i} + xy\hat{j}$  integrated round the square whose sides are  $x = 0, y = 0, x = a, y = a$  in the plane  $z = 0 \cdot (CO4, K3)$   
8. Answer any one of the following:-  
8-a. (i) Shreya started from point P and 2 m towards West. She then took a right turn and walking 5 m. She finally took a left turn, walked 3 m dstopped at a point Q. How far is point Q from point P?  
(ii) Ratio of ages of Reena and Prema is 2 : 3 and the ratio of ages of Tiya and Reena is 3 : 1. If the ratio of age of Prema four years hence to age of Tiya and Reena is 3 : 5 : 9, what is the total of the ages of all three? (CO5, K1)  
8-b. (i) Pointing to a photograph Lata says, "He is the son of the only son of my grandfather." How is the man in the photograph related to Lata?

(ii) The milk and water in a mixture are in the ratio 7:5. When 15 L of water are added to it, the ratio of milk and water in the new mixture becomes 7:8. Find the total quantity of water in the new mixture . (CO5,K1)

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