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Question Paper Code:92005

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Second Semester

19UMA205- Calculus and Transforms Techniques

Electrical and Electronics Engineering

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

PART A

10*2 = 20 Marks

(Answer Any Ten of the following Questions)

1. Compute the particular Integral $(D^2 + 16)y = \cos 4x$ CO1 – App
2. Compute the particular Integral $(D^2 + 1)y = x^2$ CO1 – App
3. Transform $[(x+2)^2 D^2 + 3(x+2)D + 5]y = 20$ into linear equation with constant coefficient CO1 – App
4. If $\vec{F} = (16x - 3y + z)\vec{i} + (x + 2ay - 2z)\vec{j} + (3x + 2y - 2z)\vec{k}$ is solenoid find the value of 'a'. CO2 – App
5. Find the unit vector normal to the surface $x^2yz = 4$ at (1,1,0) CO2 – App
6. If $\vec{F} = 2y\vec{i} + z\vec{j} + x\vec{k}$ then find (i) $\nabla \circ \vec{F}$ (ii) $\nabla \times \vec{F}$ CO2 – App
7. Compute $L[(2t+1)^2]$ CO3 – App
8. Compute $L^{-1}\left[\log\left(\frac{s+1}{s-2}\right)\right]$ CO3 – App
9. Compute $L\left[\frac{1}{\sqrt{t}}\right]$ CO3 – App
10. Describe Dirichlet's Conditions CO6 – App
11. Calculate a_n in the Fourier series expansion of $f(x) = 3x^2$ in $(0, 2\pi)$. CO4 – App
12. Determine the root mean square value of the function $f(x) = 3x$ in $(0, 2)$ CO4 – App

- 13 Determine the Fourier transform of $f(x) = \begin{cases} \sqrt{\pi} & |x| \leq 1 \\ 0 & |x| > 1 \end{cases}$ CO5 – App
- 14 Determine the Fourier sine transform of e^{4x} CO5 – App
- 15 State and Prove Change of scale property of Fourier Transform. CO5 – App

PART B

(5*16 = 80 Marks)

16. (a) Solve the method of variation of parameters, $(D^2 + 1)y = \sec^2 x$ CO1-App (16)

Or

- (b) Solve the differential equation $(x^2 D^2 - 3xD - 5)y = x^2 \sin(\log x)$ CO1-App (16)

- 17 (a) Verify Divergence theorem for $\vec{F} = (x^2 - yz)\vec{i} + (y^2 - xz)\vec{j} + (z^2 - xy)\vec{k}$ over the rectangular parallelepiped $0 \leq x \leq 2, 0 \leq y \leq 3, 0 \leq z \leq 4$ CO2-App (16)

Or

- (b) Determine the Fourier Transform of the function defined by CO5- App (16)

$$f(x) = \begin{cases} 9 - x^2 & \text{if } |x| < 3 \\ 0 & \text{if } |x| \geq 3 \end{cases} \text{ and hence Prove that (i) } \int_0^{\infty} \frac{\sin t - t \cos t}{t^3} dt = \frac{\pi}{4}$$

$$(ii) \int_0^{\infty} \left(\frac{\sin t - t \cos t}{t^3} \right)^2 dt = \frac{\pi}{15}$$

- 18 (a) Solve by using L.T. $y'' - 8y' + 7y = e^{-2t}$ given that if $y(0) = 0, y'(0) = 0$ CO3- App (16)

Or

- (b) Find the image of $|z - 3i| = 3$ under the transformation $w = \frac{1}{z}$

- 19 (a) Compute first two harmonics of the Fourier series for the following CO4- App (16) data.

x	0	2	4	6	8	10
y	9	18.2	24.4	27.8	27.5	22.0

(b) Determine the Fourier series for $f(x) = (\pi - x)^2$ in $0 < x < 2\pi$

CO4- App (16)

Or

20

(a) Determine the Fourier Cosine transform of e^{-ax} and hence evaluate

CO5- App (16)

$$\int_0^{\infty} \frac{dx}{(x^2 + 49)(x^2 + 36)}$$

Or

(b) Determine the Fourier sine transform of e^{-ax} and hence evaluate

CO5- App (16)

$$\int_0^{\infty} \frac{dx}{(x^2 + 49)(x^2 + 36)}$$

