A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U2M05

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Second Semester

Electrical and Electronics Engineering

21UMA205- Calculus and Transform Techniques

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Particular Integral of $(D^5 - D)y = 12e^x$ CO1-App

(a) $4e^x$ (b) $3e^x$ (c) $4xe^x$ (d) $3xe^x$

2. Complementary function of $(D^2 - 2D + 1)y = \cosh 2x$ CO1-App

(a) $(A + Bx)e^{2x}$ (b) $(A + Bx)e^{-2x}$ (c) $Ae^{-x} + Bxe^{-x}$ (d) $Ae^{x} + Bxe^{x}$

3. If $\vec{F} = (9x + y)\vec{i} + (7y - 2z)\vec{j} + (2x - \lambda z)\vec{k}$ is solenoidal then the value of 'λ'. CO2-App

(a) 0 (b) 1 (c) 3 (d) $\bar{r}$

4. $\vec{F} = 3x\vec{i} + 4\overrightarrow{yj} - z\vec{k}$ then find $\nabla \circ \vec{F}$ CO2-App

(a) 8 (b) 6 (c) 7 (d) 0

5. Laplace transforms of $L[4t]$ CO3- U

(a) $\frac{4}{s}$ (b) $\frac{4}{s^2}$ (c) $\frac{4}{s} + \frac{4}{s^2}$ (d) $\frac{4}{s} - \frac{4}{s^2}$

6. Laplace transforms of $L\left[e^{-2t}\right]$ CO3- U

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

7. The fourier constant term a_0 of $f(x) = x$ in $(0, 2\pi)$ CO4-App

(a) π (b) 2π (c) 3π (d) 4π

8. The fourier constant term a_0 of $f(x) = (2\pi - x)$ in $(0, 2\pi)$ CO4-App

(a) π^2 (b) 3π (c) -3π (d) 2π

9. If $F[f(x)] = F(s)$, *then* $F[ax]$, $a > 0$ CO6-U

(a) $aF\left(\frac{a}{s}\right)$ (b) $\frac{1}{a}F\left(\frac{s}{a}\right)$ (c) $aF\left(\frac{s}{a}\right)$ (d) $\frac{1}{a}F\left(\frac{a}{s}\right)$

10. Fourier Sine transform of e^{-3x} CO5-U

(a) $\sqrt{\frac{2}{\pi}}\frac{3}{s^2+9}$ (b) $\sqrt{\frac{2}{\pi}}\frac{s}{s^2-9}$ (c) $\sqrt{\frac{2}{\pi}}\frac{s}{s^2+9}$ (d) $\sqrt{\frac{2}{\pi}}\frac{3}{s^2-9}$

PART – B (5 x 2= 10Marks)

11. Compute the particular Integral $(D^2 + 16)y = \cos 4x$ CO1-App

12. f $\vec{F} = (4x - 5y)\vec{i} + (3y + 5z)\vec{j} + (8x + \lambda z)\vec{k}$ is solenoidal find the value of $'\lambda'$. CO2-App

13. Compute $L\left[(t+1)^2\right]$ CO3-App

14. State Dirichlet's conditions CO4-R

15. Define Fourier transform pair CO5-App

PART – C (5 x 16= 80Marks)

16. (a) (i) Solve the method of variation of parameters, CO1-App (8)

$(D^2 + 1)y = co\sec x \cot x$

(ii) Solve the differential equation CO1- App (8)

$[(x+5)^2 D^2 - 4(x+5)D + 4]y = 6\sin 3[\log(x+5)]$

Or

(b) (i) Solve the differential equation $(D^2 + 5D + 6)y = e^{-x} + \cos 2x$ CO1- App (8)

(ii) Solve the differential equation CO1- App (8)

$(x^2D^2 - 5xD - 8)y = x^2\cos(log x)$

17. (a) Verify Divergence theorem for $\vec{F} = 3x^2\vec{i} + 4y^2\vec{j} + 5z^2\vec{k}$ CO2-App (16)

over the rectangular parallelepiped $0 \le x \le 1,\ 0 \le y \le 1,\ 0 \le z \le 1$

Or

	(b)	Verify Green's theorem for $\int_C (3x - 8y^2)dx + (4y - 6xy)dy$, C is bounded by X = 0, Y = 0, X + Y= 1.	CO2 -App	(16)
18.	(a)	(i) Find the Laplace transform of f(t) = $\begin{cases} k & ,0 < t < a \\ -k & ,a < t < 2a \end{cases}$ and $f(t + 2a) = f(t)$	CO3-App	(8)
		(ii) Solve by the convolution theorem $L^{-1}\left[\frac{s}{(s^2 + a^2)^2}\right]$.	CO3-App	(8)
		Or		
	(b)	(i) Solve by using L.T. $y'' - 5y' + 6y = e^{-t}$ given that if $y(0) = 0,\ y'(0) = 0$	CO3-App	(8)
		(ii) Solve by using convolution theorem $L^{-1}\left[\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}\right]$	CO3-App	(8)
19.	(a)	Express $f(x) = x^2$ as a Fourier series of period 2π in the interval $0 < x < 2\pi$.	CO4-App	(16)
		Or		
	(b)	(i) Compute first two harmonics of the Fourier series for the following data.	CO4-App	(8)

x	0	2	4	6	8	10	12
y	10	12	20	24	26	17	10

		(ii) Find the Half range sine series for $f(x) = x$ in $(0, \pi)$	CO4-App	(8)
20.	(a)	Compute the Fourier Transform of $f(x) = \begin{cases} a - \lvert x \rvert & if\ \lvert x \rvert \le a \\ 0 & if\ \lvert x \rvert > a \end{cases}$ and hence evaluate (i) $\int_0^\infty \left(\frac{\sin x}{x}\right)^4 dx$ (ii) $\int_0^\infty \left(\frac{\sin x}{x}\right)^2 dx$	CO5-App	(16)
		Or		
	(b)	Find Fourier sine & cosine transform x^{n-1} and hence Show that $\frac{1}{\sqrt{x}}$ is self reciprocal under Fourier sine & cosine transform	CO5- App	(16)