

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: U2M05

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

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)

- Particular Integral of $(D^5 - D)y = 12e^x$ CO1-App
(a) $4e^x$ (b) $3e^x$ (c) $4xe^x$ (d) $3xe^x$
- 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) $Ae^x + Bxe^x$
- 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) \vec{r}
- $\vec{F} = 3x\vec{i} + 4y\vec{j} - z\vec{k}$ then find $\nabla \circ \vec{F}$ CO2-App
(a) 8 (b) 6 (c) 7 (d) 0
- 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) $\frac{4}{s} - \frac{4}{s^2}$
- Laplace transforms of $L[e^{-2t}]$ CO3- U
(a) $\frac{1}{s-2}$ (b) $\frac{s}{s-2}$ (c) $\frac{s}{s+2}$ (d) $\frac{1}{s+2}$
- 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. If $\vec{F} = (4x - 5y)\vec{i} + (3y + 5z)\vec{j} + (8x + \lambda z)\vec{k}$ is solenoidal find the value of ' λ '. CO2-App
13. Compute $L[(t + 1)^2]$ 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)
 $(D^2 + 1)y = \csc x \cot x$
 (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)
 $(x^2 D^2 - 5xD - 8)y = x^2 \cos(\log x)$
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 $0 \leq x \leq 1, 0 \leq y \leq 1, 0 \leq z \leq 1$
 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 $f(x) = \begin{cases} a - |x| & \text{if } |x| \leq a \\ 0 & \text{if } |x| > a \end{cases}$ CO5-App (16)

- and hence evaluate (i) $\int_0^{\infty} \left(\frac{\sin x}{x} \right)^4 dx$ (ii) $\int_0^{\infty} \left(\frac{\sin x}{x} \right)^2 dx$

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)

