KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(3 Pages) **Reg. No:……**

Question Code: 26E00208 **Course code : 24UMMA42**

UG Degree - End Semester Examinations, April 2026

Fourth Semester

B.Sc., MATHEMATICS

Fourier Series and Integral Transforms

(For those who joined in July 2024 onwards)

Time : 3Hours **Maximum : 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

CO:1 K:1 1. Which one of the following is an odd function?

(a) $y = cosx$ (b) $y = sinx$

(c) $y = |x|$ (d) $y = x^2$

CO:1 K:1 2. If $f(x)$ is an even function, then $\int_{-\pi}^{\pi} f(x) \sin nx =$

(a) 0 (b) 1

(c) $-\pi$ (d) π

CO:2 K:2 3. In the half-range cosine series for $f(x) = x^2$ in $(0, \pi)$ the value of a_0 is

(a) 0 (b) $\frac{2\pi^2}{3}$

(c) $\frac{3\pi^2}{2}$ (d) $\frac{4\pi^2}{3}$

CO:2 K:1 4. The process of finding the Fourier series for a function given by numerical values is _____

(a) Analysis (b) Fourier Transform

(c) Harmonic analysis (d) Numerical integration

CO:3 K:1 5. Fourier transform of $f(x)$ is denoted by

(a) $f(s)$ (b) $\bar{f}$(s)

(c) $\bar{f}$(x) (d) $F[f(x)]$

CO:3 6. $F[f(ax)]$= _____

K:2

(a) $\frac{1}{a}F(\frac{s}{a})$ (b) $F(\frac{s}{a})$

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

CO:4 7. L(1) = _____

K:2

(a) s (b) $\frac{1}{s}$

(c) $\frac{1}{s^2}$ (d) 1

CO:4 8. L(e^{at}) =

K:2

(a) $\frac{1}{s+t}$ (b) $\frac{1}{s-a}$

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

CO:5 9. $L^{-1}(\frac{1}{s^2})$ =

K:2

(a) x (b) 1

(c) e^{ax} (d) x^2

CO:5 10. $L^{-1}(\frac{1}{s^2+a^2})$ =

K:2

(a) sin hax (b) cos hax

(c) sin ax (d) cos ax

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:1 11. (a) Find the Fourier coefficient a_n for the function

K:3 $f(x) = (l - x)^2$ in $(0,2l)$.

(OR)

(b) Find the Fourier series expansion of $f(x) = sinax$ in $(-l, l)$.

CO:2 12. (a) Find the half-range sine series of $f(x) = x$ in $(0, l)$.

K:3

(OR)

(b) Find the complex form of the Fourier series of $f(x) = e^x$ in $(0,2)$.

CO:3 13. (a) Using Fourier integral formula,

K:3 Prove that $e^{-x}cosx = \frac{2}{\pi}\int_0^\infty \frac{\lambda^2+2}{\lambda^4+4}\ cos\lambda x\ d\lambda$.

(OR)

(b) Find the Fourier transform of $e^{-a^2x^2}$.

CO:4 K:3 14. (a) Find $L[sin^2\ 2t]$.

(OR)

(b) Evaluate $\int_0^\infty \frac{e^{-t}-e^{-2t}}{t}\ dt$.

CO:5 K:3 15. (a) Find $L^{-1}\left[\frac{s-3}{s^2+4s+13}\right]$.

(OR)

(b) Find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 500 words.

CO:1 K:3 16. (a) Find the Fourier series of $f(x) = x^2$ in $(0,2l)$.

(OR)

(b) Find the Fourier series of period 2π for the function $f(x) = |cosx|$ in $-\pi < x < \pi$.

CO:2 K:3 17. (a) Find the half range cosine series of $f(x) = \sin x$ in $(0, \pi)$.

(OR)

(b) Find the complex form of the Fourier series of $f(x) = e^{-ax}$ in $(-l, l)$.

CO:3 K:4 18. (a) Find the Fourier transform of given $f(x)$

$$f(x) = \begin{cases} 1 & for\ |x| < a \\ 0 & for\ |x| > a \end{cases}.$$

(OR)

(b) Using the Parseval's identity for Fourier cosine transform of e^{-ax}, Show that $\int_0^\infty \frac{dx}{(x^2+a^2)^2}$.

CO:4 K:3 19. (a) Find $L[f(t)]$ if $f(t) = t^2 + \cos 2t \cos t + sin^2\ 2t$.

(OR)

(b) Evaluate $\int_0^\infty te^{-3t}cost\ dt$.

CO:5 K:3 20. (a) Find $L^{-1}\left[\frac{1}{(s+1)(s^2+2s+2)}\right]$.

(OR)

(b) Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)}\right]$.