Avinashilingam Institute for Home Science and Higher Education for Women
Deemed to be UniversityEstd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)
Re-accredited with 'A++' Grade by NAAC. Recognised by UGC Under Section 12B
Coimbatore - 641 043, Tamil Nadu, India

Continuous Internal Assessment Test- I, February 2025
Semester - IV

Class : II PG | **Time : 2 Hours**
Major : Mathematics | **Max.Marks : 60**

23MMAC23 - Mathematical Methods

Course Outcomes:
CO1: Understand the concepts of Fourier transform.
CO2: Apply Fourier transform in physical sciences
CO3: Evaluate integral equations of various types.
CO4: Apply integral equations in boundary value problems.
CO5: Identify problems in calculus of variation.

Part - A

Choosethecorrectanswer **6x1=6**

1.Relate with the correct choice: $te^{\frac{1}{2}t^2}$ is a self-reciprocal function under transform ________ CO1K1
a. Fourier b. Fourier cosine c. Fourier sine d. Laplace

2. F_cF_c = CO1K1
a. F_c^2 b. I c. 1 d. F_c

3. Cite the correct choice: $\frac{\partial^2 u}{\partial x^2}=\frac{1}{\kappa}\frac{\partial u}{\partial t}$ is called the _______ equation. CO2K1
a. Fourier b. Fourier cosine c. Fourier sine d. Laplace

4. Select the name of the identity given by $F[f\circ g;\xi]=F(\xi)G(\xi)$ where $F(\xi)$ and $G(\xi)$ Fourier transform of f and g respectively, CO2K1
a. Parseval's identity b. Bessel's identity
c. convolution theorem d. inversion theorem

5. State which of the following theorem is concerned with the study of the homogeneous equation $g(s)=f(s)+\lambda_0\int K(s,t)\,g(t)\,dt$ to possess a solution with $D(\lambda_0)=0$. CO3K1
a. Fredholm's first theorem b. Fredholm's second theorem
c. Fredholm's third theorem d. Fredholm's kernel

6. State Fredholm's first theorem: The inhomogeneous equation $g(s)=f(s)+\lambda\int_a^b K(s,t)\,g(t)\,dt$ to possesses a unique solution provided CO3K1
a. $D(\lambda)=0.$ b. $D(\lambda_0)=0.$ c. $D(\lambda)\neq 0.$ d. $D(\lambda)=1$

Part - B **3x6=18**

Answer any two questions

Each answer should not exceed 400 words or two pages

7. a. Prove that if AB is the arc, $\theta_1 \le \arg \le \theta_2$ of the circle |z| = R and if z f (z) = k uniformly as R→∞, then $\lim_{R\to\infty} \int_{AB} f(z)\,dz = ik(\theta_1 - \theta_2)$ CO1K2

(or)

7. b. Prove that $F_s\left[t^{-1}e^{-at}, \xi\right] = \sqrt{\frac{2}{\pi}}\cot^{-1}\left(\frac{a}{\xi}\right), a>0$ CO1K3

8. a. State and prove convolution integral is commutative and associative. CO2K3

(or)

8. b. Show that $\int_0^\infty F_s(\xi)G_c(\xi)\sin\xi t\,d\xi = \frac{1}{2}\int_0^\infty [f(u)g(|u-t|).g(|u+t|)]du$. CO2K3

9. a. Find the eigen value and eigen function of the homogeneous integral equation. CO3K1

$$g(x) = \lambda\int_1^2\left(st + \frac{1}{st}\right)g(t)\,dt$$

(or)

9. b.Solve the integral equation. $g(x) = f(s) + \lambda\int_0^1 e^{s-t}\,g(t)\,dt$ CO3K3

Part - C **3 x12 =36**

Answer any one question

Each answer should not exceed 800 words or four pages

10. a.State and prove the following: CO1K1
    (i) Fourier cosine inversion theorem and
    (ii) Fourier sine inversion theorem

(or)

10. b. Prove $F[e^{-t^2}, \xi] = 2^{1/2}\, e^{\xi^2/2}$ CO1K3

11. a. State and prove Parseval's theorem for cosine and sine transform. CO2K2

(or)

11. b. Derive the Laplace equation in an infinite strip with one set of boundary conditions. CO2K3

12. a. Solve the integral equation and find the eigen value. CO3K1

$$g(x) = f(s) + \lambda\int_0^1 (s+t)\,g(t)\,dt$$

(or)

12. b.State and prove the Fredholm theorem. CO3K2

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