Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 08

PHD (Mathematical Sci.)
METHODS IN APPLIED MATH
Subject Code : MPHM-102

Time : 3 Hrs. **Max. Marks : 100**

INSTRUCTIONS TO CANDIDATES :
1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

Q1. Reduce the IVP $y'' + y = \cos x,\ y(0) = 0,\ y'(0) = 1$ into integral equation. Derive the original differential equation with the initial conditions from the integral equation obtained.

Q2 a) Establish Integral equation with separable kernels.

b) Solve $y(x) = x + \int_0^x (t - x)\, y(x)\, dx$ using successive approximation method.

Q3 Find the Fourier series of the function :

$$f(x) = \begin{cases} 1, & 0 \le x \le 1 \\ -1, & 1 \le x \le 2 \\ 0, & 2 \le x \le 3 \end{cases}$$

Q4 Find the complex form of Fourier Integral representation for the function :

$$f(x) = \begin{cases} |x|, & -\pi \le x \le \pi \\ 0, & \text{elsewhere} \end{cases}$$

Verify that it is same as that obtained by using the Fourier cosine representation.

Q5 Find the solution of the differential equation :

$$y' - 2y = H(t)e^{-2t}, \quad -\infty < t < \infty$$

Using Fourier transforms where $H(t) = u_0(t)$ is the unit step function.

Q6 a) Explain Hankel transforms and its real life applications.

b) Use the time convolution to find the inverse of the function.

$$\frac{1}{(iw+k)^2};\ k>0$$

Q7 Differentiate between wavelet transform and Fourier transform through suitable examples.

Q8 a) Write short note on the following with examples.

i) Approximate discrete-time signals using delta function.

ii) Basic construction by scaling.

b) Examine the difference between scaling and wavelet function spaces.