

**School of Basic Sciences**  
**Bachelor of Science Honours in Physics**  
**Mid Term Examination - May 2024**

**Duration : 90 Minutes**  
**Max Marks : 50**

**Sem II - C1UD201T - Mathematical Physics-II**

*General Instructions*  
*Answer to the specific question asked*  
*Draw neat, labelled diagrams wherever necessary*  
*Approved data hand books are allowed subject to verification by the Invigilator*

- 1) Illustrate the function  $f(x)$  is periodic. K2 (2)  

$$f(x) = \sin(\sqrt{3}x) + \cos(\sqrt{3}x)$$
- 2) Show that  $f(x) = \sin(x) + \cos(2x)$  is periodic. K1 (3)
- 3) Prove that the sine function is orthogonal to the cosine function over the interval  $[0, 2\pi]$ . K2 (4)
- 4) Find the ordinary points, Singular points, regular singular points, and irregular singular points of the differential equation: K2 (6)  

$$x^3(x-1)\frac{d^2y}{dx^2} + (x-1)\frac{dy}{dx} + 4xy = 0$$
- 5) Solve in series the differential equation K3 (6)  

$$\frac{d^2y}{dx^2} + xy = 0$$
- 6) Solve the differential equation  $y'' - y = 0$  using the power series method. K3 (9)
- 7) Solve the differential equation using the power series method around  $x=1$  K4 (8)  

$$x^2y'' + xy' - y = 0$$
- 8) Solve the differential equation using the Frobenius series method. K4 (12)  

$$x^2y'' + xy' + (x^2 - 1)y = 0$$

**OR**

Calculate the Fourier coefficients for the function  $f(x) = \exp(-x)$  in  $(0, 2\pi)$  K4 (12)