KIX 1002 Engineering Mathematics 2

Tutorial 11

1. The function $f(t) = 1 - t^2$ is to be represented by a Fourier series expansion over the finite interval $0 < t < 1$. Obtain a suitable

   (a) full-range series expansion

   (b) half-range sine series expansion

   (c) half-range cosine series expansion

2. Sketch the graphs of:

   (a) full-range series expansion

   (b) half-range sine series expansion

   (c) half-range cosine series expansion

   for $f(t) = 1 - t^2$ in Q1 for $-2 < t < 2$. Draw and label the period p and the finite interval τ on each graph.

3. The temperature distribution $T(x)$ at a distance x, measured from one end, along a bar of length 10 inch is given by:

$$T(x) = 2x(10 - x) \quad (0 \leq x \leq 10) \tag{1}$$

   Express $T(x)$ as a Fourier series expansion consisting of sine terms only.

4. Suppose a uniform beam of length L is simply supported at $x = 0$ and at $x = L$. If the load per unit length is given by $w(x) = \frac{w_0 x}{L}$, $0 < x < L$, then the differential equation for the deflection $y(x)$ is

$$EI\frac{d^4y}{dx^4} = \frac{w_0 x}{L} \tag{2}$$

   where E, I and w_0 are constants.

   (a) Expand $w(x)$ in a half-range sine series.

   (b) Find a particular solution $y(x)$ of the differential equation.