PHYS 301
HOMEWORK #4

Due : 13 February 2017

Do all integrals by hand; you may check your answers via *Mathematica* but must show all work.

1. Show for m, n integers :

$$\int_{-\pi}^{\pi} \sin(m\,x)\sin(n\,x)\,dx = \begin{cases} 0, & m \neq n \\ \pi, & m = n \end{cases}$$

$$\int_{-\pi}^{\pi} \sin(n\,x)\cos(m\,x)\,dx = 0$$

$$\int_{-\pi}^{\pi} \cos(m\,x)\cos(n\,x)\,dx = \begin{cases} 0, & m \neq n \\ \pi, & m = n \\ 2\pi, & m = n = 0 \end{cases}$$

2. Consider the function :

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$$

Find the Fourier coefficients and then write the Fourier series both in closed form and by writing out the first three non zero terms of each series.

3. Consider the function :

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ x^2, & 0 < x < \pi \end{cases}$$

Find the Fourier coefficients and write the Fourier series both in closed form and by writing out the first three non-zero terms of each series.

4. Find the Fourier coefficients and write the Fourier series in closed form and also the first three non - zero terms of each series for :

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \sin(2\,x), & 0 < x < \pi \end{cases}$$

5. Find the Fourier coefficients and Fourier series for the function :

$$f(x) = \begin{cases} -1, & -\pi < x < 0 \\ 1, & 0 < x < \pi \end{cases}$$

Write out the first three non-zero terms of each series.