# PHYS 301 HOMEWORK \#6 

## Due : 24 Feb 2016

You may use Mathematica to compute Fourier coefficients. If you do, please include the relevant Mathematica output with your solution.

1. Problem 9-60 from text
2. Find the complex Fourier series for the function $f(x)=x$ on $[-\pi, \pi]$. Find an expression for the complex coefficients, and show that the complex Fourier series matches the Fourier trig series out to the $e^{ \pm 5 i x}$ terms. (Assume the function repeats so that the Dirichlet conditions are satisfied).
3. Find the complex Fourier series for the function:

$$
\mathrm{f}(\mathrm{x})= \begin{cases}0, & -3<\mathrm{x}<\mathrm{L} \\ \mathrm{x}, & 0<\mathrm{x}<\mathrm{L}\end{cases}
$$

Assume the function repeats so that the Dirichlet conditions are satisfied. Find an expression for the complex Fourier coefficients and show that the complex series matches the trig series out to the $n=$ 5 terms.
4. Use the function described in question 4 of HW 5 in conjunction with Parseval' s theorem to evaluate:

$$
\sum_{n=1}^{\infty} \frac{1}{n^{4}}
$$

You may use Mathematica to check your answer, but you must use Parseval's theorem to determine this result.
5. Write a Mathematica program that will compute the Fourier trig coefficients for the function below; will print out the Fourier series out to the $\mathrm{n}=11$ terms, and will verify the accuracy of the series by plotting the series and the original function on the same set of axes :

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

