Indian Institute of Science

E9-252: Mathematical Methods and Techniques in Signal Processing

Instructor: Shayan G. Srinivasa

Home Work #4, Fall 2016

Late submission policy: Points scored = Correct points scored $\times e^{-d}$, d = # days late

Assigned date: Nov. 13^{th} 2016 **Due date:** Nov. 20^{th} 2016 by end of the day.

PROBLEM 1: Solve problems 4.4, 4.11, 4.15 from M. Hayes book. (30 pts.)

PROBLEM 2: Let

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

(1) Obtain the Fourier series of $f(t)$ after a periodic extension. Sketch the Fourier series for some finite values of the series expansion.

(2) Let $g_N(x) = 2 \sum_{n=1}^{N} \frac{\sin(nx)}{n} - (\pi - x)$ i.e., for some finite N. Obtain the first null i.e., θ_N of $g_N^{'}(x)$ immediately to the right side of $x = 0$. By evaluation, show that $\lim_{N \to \infty} g_N(\theta_N) \approx 0.52$. What do you conclude?

Hint: You might find the following equation useful from basic calculus.
$g_N(x) = \int_0^{\theta_N} g_N^{'}(x)dx + g_N(0)$.

(20 pts.)