

ECE 320 SIGNALS AND SYSTEMS II

Problem Set 4

Fall 2002

Issued: Thursday, September 19, 2002**Due:** Monday, September 30, 2002Reading in *Oppenheim and Willsky with Nawab*

9/23/02 — Section 3.4-3.5

9/25/02 — Sections 3.6-3.7

9/30/02 — Sections 3.8-3.11

Problem ECE320-5 (started in class on 9/16)

Consider the causal LTI system described by the following difference equation:

$$y[n] + \frac{3}{2}y[n-1] - y[n-2] = x[n].$$

- What is the form of the homogeneous solution?
- Let $x[n] = u[n]$. What is the particular solution?
- Assuming $x[n] = u[n]$, state the auxiliary conditions. (Remember: the system is causal and LTI.)
- What is $y[n]$ when $x[n] = u[n]$?
- Determine the impulse response of this system. Is this system IIR or FIR?
- Use the `filter` command to check your results for parts d and e. Your writeup for this part should include the plots of $x[n]$ and $h[n]$, along with the Matlab code you used to produce them. Note that you will have to choose a reasonable interval for plotting the output of `filter`. (The analytical results may be infinite length, but you can only plot a finite number of points using Matlab.)

Your Matlab book (*Computer Explorations in Signals and Systems Using Matlab* by Buck, Daniel, and Singer) has a nice tutorial about `filter` in Section 2.2. The main information you'll need is on pages 22 and 23. You do not have to turn in the tutorial exercises.

Problem 3.22 in *Oppenheim/Willsky/Nawab*

Part a – find the Fourier series representation for the signal in Figure P3.22d only (*i.e.*, the periodic signal with the impulses in it).

Problem ECE320-6

Find the Fourier series representation for the signal $x(t)$ with period 2 given below:

$$x(t) = e^{-t} \quad \text{for } -1 < t < 1$$

Problem 3.24 in *Oppenheim/Willsky/Nawab*

Problem 3.28 in *Oppenheim/Willsky/Nawab*

Part a – find the Fourier series for the signal shown in Figure P3.28a only.

Problem ECE320-7

Consider a periodic signal $x[n]$ with period $N = 4$. Its Fourier series coefficients are:

$$a_0 = 1 \quad a_1 = 2 \quad a_2 = 0 \quad a_3 = 2 \quad .$$

Determine and sketch the signal $x[n]$.