EECE 521 Digital Signal Processing

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Reading Material

1. *Digital Signal Processing*, 4th Ed., Proakis & Manolakis
    – Required Textbook (available in bookstore)
2. **Parts of the following three books will be made available to you**:
    – B. Porat, *A Course in Digital Signal Processing*
    – J. Lim & A. Oppenheim, *Advanced Topics in Signal Processing*
        (Chapters 2 –3)
    – M. Hayes, *Statistical Digital Signal Processing and Modeling*
        (Chapter 8)

3. Lecture Notes: www.ws.binghamton.edu/fowler; see link for EECE 521; then see link under "Lectures"
    – See also for contact information and office hours

Course Outline

These above materials will be indicated in the outline below using the following abbreviations:
    – PM = Proakis & Manolakis
    – P = Porat
    – LO = Lim & Oppenheim
    – H = Hayes
Thus, for example, the notation "P-3.2" indicates "Section 3.2 of Porat's book"

> Numbers in square brackets indicate an estimate of the number of lectures for the topic.

I. **[1L]** Review and Introduction
    a. CT & DT Fourier Transforms (P-2)
    b. DT Convolution (P-2)
    c. DT Frequency Response (P-2)
    d. DT Transfer Function (P-2)
    e. Sampling Theorem (PM-6.1 – 6.2)
    f. Introduction of Course Case Study (Lecture Notes)
        "Emitter Location using Cross-Correlation Processing"

> This shows what book and section covers the topic

II. **[1.5L]** Equivalent Lowpass Signals & Bandpass Sampling
    a. Equivalent Lowpass Signals (PM-6.4.3)
    b. Bandpass Sampling (PM-6.4.1)

III. **[3L]** DFT Based Processing
    a. DFT-Based Filtering (PM-7.3)
        1. Overlap-Save
        2. Overlap-Add
    b. Windowing (P-6.1-6.3)
    c. Frequency Measurement (P-6.4/6.5)
    d. Sinusoid Detection (P-6.5)

IV. **[11L]** Multirate Processing & Filterbanks
    a. Decimation & Interpolation (PM-11.1-11.4, LO-3.0-3.2)
    b. Polyphase Filters (PM-11.5, LO-3.3)
    c. Multi-Stage Schemes (PM-11.6, LO-3.5/3.6.3)
    d. Filter Banks (PM-11.10-11.12, LO-3.6.5)
        1. Uniform DFT-Based Filter Banks (P-12.8, LO-3.6.5)
        2. Two-Channel-Based Filter Banks (PM-11.11)
    e. Cross-Correlation Processing (Web Notes)

V. **[5L]** Random Signals (Lecture Notes)
    a. Review Random Variables
    b. Random Processes
        1. Wide-Sense Stationarity (WSS)
        2. Auto-Correlation Function (ACF)
        3. Power Spectral Density (PSD)
    c. Filtering Random Processes

VI. **[6.5L]** Spectral Analysis of Random Signals (LO-2, H-8, PM-14)
    a. Introduction
    b. Nonparametric Methods
    c. Parametric Methods