ENEE 601 SIGNAL AND LINEAR SYSTEMS THEORY

SYLLABUS (Fall 2006)

Course Description: This is a first semester, required, graduate course for electrical engineering (EE) majors that covers the fundamentals of signal and linear systems theory. The course will address both continuous-time and discrete-time representations and both time-invariant and time-variant systems. Topics covered include: (1) Fundamental linear space and matrix concepts; (2) Signal representations, properties, transforms, and sampling; (3) System representations, properties, and transforms; and (4) New transforms and representations, e.g., joint-domain transforms and multirate/filterbank representations. The goal of this course is to provide the beginning EE graduate student with the foundations and tools of signal and linear system theory, particularly the time-variant case in both continuous-time and discrete-time, necessary for subsequent courses in the overall electrical engineering program, in general, and the communications and signal processing subprogram, in particular, and for conducting research in related areas. *Co-requisite*: ENEE 620. (3 Credits)

I. **Mathematical Notation and Review** (2 wks)
Basic linear space concepts; vectors, matrices, quadratic forms, matrix calculus; eigenvalues & eigenfunctions; Fourier, Laplace, & z-transforms; correlation.

II. **Signals and Sequences: Representations & Properties** (3 wks)
Representations and domains of continuous-time (CT) & discrete-time (DT) signals; conversion between CT & DT signals; sampling theorems; fundamental signals.

III. **Linear Systems: Representations & Properties** (5 wks)
Differential & difference equations; state-variable equations; input-output representations (impulse response, transition matrix, transfer function); time-variant & time-invariant; linear feedback; signal-graph concepts; stability.

IV. **Advanced Topics: New Transforms & Representations** (3 wks)
Multirate & filterbank representations; joint-domain transforms (wavelet, Gabor (STFT), Wigner, Zak, Frames).

Texts: R. D. Strum & D. E. Kirk, Contemporary Linear Systems Using MATLAB, Brooks/Cole 2000, ISBN 0-534-37172-8. (Required)
W. J. Rugh, Linear System Theory, 2nd Ed., Prentice-Hall, 1996, ISBN 0-13-441205-2. (Ref.)
P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice-Hall, 1993, ISBN 0-13-605718-7. (Ref.)

Grading: Hmwk ~ 20% Exams/Projects ~ 40% Final ~ 40%

Class Meetings: TuTh 4 -5:15pm, Room TBA

Instructor: Prof. Joel M. Morris, PhD, TRC 255, (410) 455-3503/6500(fax), morris@umbc.edu