MTE 7103: Digital Signal Processing:

Course Objective

This course will examine a number of advanced topics and applications in one-dimensional digital signal processing, with emphasis on optimal signal processing techniques. Topics will include modern spectral estimation, linear prediction, short-time Fourier analysis, adaptive filtering, plus selected topics in array processing and homomorphic signal processing, with applications in speech and music processing.

Discrete-time signals and systems; the z-transform. Input-output relationships; discrete-time networks. The discrete-time Fourier transform and sampling; practical sampling issues; signal quantization. The discrete Fourier transform, the fast Fourier transform, and high-speed convolution. Filter design from analog models; impulse-invariant, bilinear, and spectral transformations. FIR filter design, windowing, and frequency-sampling methods. Equiripple filter design. Coefficient quantization. Examples of DSP applications and implementations.

Implementations of Digital Signal Processing: Implementation of bit-parallel, bit-serial, and digit-serial multiplier and adder structures; carry-save arithmetic; register minimization. Architectural transformation techniques: folding and unfolding, pipelining, and retiming of computations. Performance and hardware tradeoffs in VLSI DSP system design. Pipelined and parallel direct-form FIR and IIR filter structures. Pipelined adaptive filter structures. Architectures for the fast Fourier transform.

Teaching and Learning Pattern

The teaching of students will be conducted through lectures, tutorials, short classroom exercises, case studies, group discussions among the students and projects aimed at solving real life problems. The lecture material will be availed to the students in advance to enable them have prior reading. Solving real life problems in each theme or a number of topics will enhance the students' understanding of the problem based learning techniques.

Assessment method

Assessment will be done through coursework which will include assignments, class room and take home tests, project work and presentations and a written examination.

Course work will carry a total of 40% and written examination carries 60%. Coursework marks will be divided into; Assignments 5%, Tests 10% and Practical/project Work 25%.

References:

[1] Oppenheim&Schafer "Digital Signal Processing", PrenticeHall

[2] JohnG. Proakis,DimitrisKManolakis "Digital Signal Processing", PrenticeHall 2006-04-07

[3] John G.Proakis and Dimitus G.Manolakis, "Digital Signal Processing, Principles, Algorithms and applications, Prentice Hall of India, New Delhi 3rd edition, 2002

[4] Lonnie C. Ludeman "Fundamentals of Digital Signal Processing", Harper & Row Publishers Inc, ISBN: 0-06-044093-7

[5] Sanjit K.Mitra, "Digital Signal Processing", McGraw Hill, ISBN: 0073-38049-0