Course Title: Digital Signal Processing in Communications

Course Code: EE4015

Units: 3

Level: B4

Course Aims & Objectives:
This course aims to provide students with a good foundation and understanding of digital signal processing techniques in communications. The objectives of the course are intended to enable students to design digital signal processing systems for various areas of applications and filters, implement digital filters and analyse digital signals and systems.

Intended Learning Outcomes:
On completion of this course, the students will be able to:

1. Process analogue signals.
2. Implement digital filters.
3. Design analogue and digital filters.
4. Analyse signals and systems.

Syllabus:
Review of signals and systems
Classification of signals and systems, difference equations, impulse response, convolution, frequency response, discrete-time Fourier transform.

z-transform
Region of convergence, properties of z-transform, inverse z-transform, relation to discrete-time Fourier transform, transfer function, poles and zeros, relation to frequency response.

Digitization of analogue signals
Sampling of analogue signals, sampling theorem, aliasing and prefiltering, analogue-to-digital conversion, uniform and non-uniform quantization, analysis of quantization error, reconstruction of analogue outputs, practical considerations of ADC and DAC, digital processing of signals.

Digital filter design
Classification of digital filters, finite impulse response (FIR) and infinite impulse response (IIR) filters, realizations of FIR and IIR digital filters, direct forms, transposed structures, parallel structures, cascade structures, linear phase structures, finite word-length effects.

Properties of FIR filters, magnitude and phase responses, window design methods, frequency sampling design methods.

Properties of IIR filters, magnitude and phase responses, design of analogue filters, analogue to digital transformation, impulse invariant method, bilinear transformation, pre-warping, frequency transformation.
Discrete Fourier Transform

Applications of DSP in Communications
Transmultiplexing, echo cancellation, equalization, adaptive echo canceller, adaptive equalizer.

Laboratory Experiment:
Nil

Teaching pattern:
Duration of course: 1 semester
Suggested lecture/tutorial/laboratory mix: Lecture Hour: 26 hours
Tutorial Hour*: 13 hours
*may be substituted with lectures/demonstration

Assessment pattern:
Examination duration: 2 hours, at the end of the semester
Percentage of coursework, examination, etc.: 30% CW; 70% Exam

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Pre-requisites: (please quote course code & title)
EE3118 Linear Systems and Signal Analysis
or
EE3210 Signals and Systems
or
EE3112 Signal Analysis [for 2002/03 cohort & before]

Pre-cursor: (please quote course code & title)
Nil

Exclusive Course: (please quote course code & title)
Nil

Equivalent Courses: (please quote course code & title)
EE3202 (IT3302 old code) Digital Signal Processing

Equivalent to the Old Course Code and Title: (please quote course code & title)
Nil

Textbook:

Reference Book: