Course Code: B39SB  
Full Course Title: Time Frequency and Signal Analysis  
SCQF Level: 9  
SCAF Credits: 15  
Available as Elective: No

DELIVERY LEVEL  
Undergraduate: Yes  
Postgraduate Taught: No  
Postgraduate Research: No

Additional Information: 
Course being delivered at the specified campus(es) and also by collaborative partner - Ocean University of China.

COURSE AIMS
To introduce, and establish an understanding of, Fourier analysis of aperiodic signals, sampled data (discrete-time) systems and digital communication systems.

LEARNING OUTCOMES – SUBJECT MASTERY
- An understanding of the time and frequency domain characteristics of continuous signals
- An understanding of the time and frequency domain characteristics of discrete-time systems
- An understanding of sampling theory and basic discrete time system properties
- An understanding of basic communication system principles.

SM1p Continuous Fourier transform and its use for signal filtering purposes. Teaches time- and frequency-domain principles for discrete-time signals useful in a wide range of applications. Also z-transform analysis. Presents an introduction to the basic principles in analog and digital communications including signal modulation, digital transmission of analogue signals, and elements of information theory. SM2p Introduces discrete-time forms of Fourier analysis - DTFT and DFT, discrete-time convolution and correlation, and z-transform theory. Amplitude, frequency, and phase modulation. Sampling. Digital carrier modulation systems. Discrete memoryless channels. Channel capacity. SM3p Teaches fundamentals of digital signal processing and of analogue and digital communications. EA1p Enables students to demonstrate a knowledge and understanding of applications of Fourier analysis and analogue and digital signals and systems. EP2p Introduces students to the use of a DSP development system environment and to the use of MATLAB.

LEARNING OUTCOMES – PERSONAL ABILITIES
- Use of DSP development environment.
- Ability to direct & take responsibility for own work.
- Undertake critical evaluations of a wide range of experimental work

SYLLABUS
Spectral representation of aperiodic signals, Fourier transform, physical interpretations, line-spectra, basic properties of
Fourier transform.

Introduction to discrete-time systems; sampling, reconstruction and aliasing; discrete convolution and correlation; discrete-time impulse responses; Fourier analysis of discrete time systems (discrete time and discrete Fourier transforms); frequency response of discrete-time systems; spectrum analysis; windowing; difference equations; z-transform; z-transfer function representation of discrete-time systems.

Signal transmission and filtering: frequency response, signal distortion during transmission, fundamentals of signal filtering.

Introduction to baseband digital communication systems; PSD; channel bandwidth; Nyquist signalling theory; amplitude, frequency, and phase modulation.

Basic information theory and probability; Shannon channel capacity.

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