Course code	Course name	L-T-P-Credits	Year Of Introduction
AE306	Digital Signal Processing	3-0-0-3	2016

Prerequisite : Nil

Course Objective

- To introduce the basic concepts and techniques for processing signals on a Computer.

Syllabus

Discrete-time and digital signals- DFT and the FFT- Z-transform- FIR Filters- IIR Filters- Filter Realization- Computer architectures for signal processing.

Expected outcome

- The students will be familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.

Text Books

1. Chen, C.T., "*Digital Signal Processing: Spectral Computation & Filter Design*", Oxford Univ. Press, 2001
2. Ifeachor, E.C., & Jervis, B.W., *"Digital Signal Processing: A Practical Approach*", 2/e, Pearson Education Asia, 2002.
3. Proakis, J.G. & Manolakis, D.G., "*Digital Signal Processing: Principles, Algorithms, & Applications*", 3/e Prentice Hall of India, 1996.

Reference Books:

1. Embree, P.M., & Danieli, D., *"C++ Algorithms for Digital Signal Processing*", 2/e, Prentice Hall Upper Saddle River, NJ, 1999.
2. McClellan, J.H., Schafer, R.W., & Yoder, M.A., *"DSP First: A Multimedia Approach*", Prentice Hall Upper Saddle River, NJ, 1998
3. Mitra, S.K., "*Digital Signal Processing: A Computer-Based Approach*", McGraw Hill, NY, 1998

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Signal Processing Fundamentals: Discrete-time and digital signals, A/D, D/A conversion and Nyquist rate, Frequency aliasing due to sampling, Need for anti-aliasing filters. Discrete Time Fourier transform and frequency spectra, Spectral computation, Computational complexity of the DFT and the FFT, Algorithmic development and computational advantages of the FFT, Inverse FFT, Implementation of the FFT, Correlation of discrete-time signals.	7	15%
II	Discrete-time systems, Difference equations and the Z-transform, Analysis of discrete-time LTIL systems, Stability and Jury's test.	6	15%
	FIRST INTERNAL EXAMINATION		
III	FIR Filters: Ideal digital filters, Realizability and filter specifications, Classification of linear phase FIR filters, Design using direct truncation, window methods and frequency sampling, Least-squares optimal FIR filters,	7	15%

	Minimax optimal FIR filters, Design of digital differentiators and Hilbert transformers, comparison of design methods.		
IV	IIR Filters: Design of analogue prototype filters, Analog frequency transformations, Impulse invariance method and digital frequency transformations, Bilinear transformation, Analog prototype to digital transformations, Difficulties in direct IIR filter design, Comparisons with FIR filters.	7	15%
SECOND INTERNAL EXAMINATION			
V	Filter Realization: Structures for FIR filters, Structures for IIR filters, State-space analysis and filter structures, Fixed point and floating-point representation of numbers, Errors resulting from rounding and truncating, Quantization effects of filter coefficients, Round-off effects of digital filters.	7	20%
VI	DSP Processors: Computer architectures for signal processing – Harvard architecture and pipelining, General purpose digital signal processors, Selection of DSPs, Implementation of DSP algorithms on a general purpose DSP, Special purpose hardware – hardware digital filters and hardware FFT processors, Evaluation boards for real-time DSP.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)