

Course code.	Course Name	L-T-P - Credits	Year of Introduction
EE407	DIGITAL SIGNAL PROCESSING	3-0-0-3	2016
<b>Prerequisite : Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To impart knowledge about digital signal processing and its applications in engineering</li> </ul>			
<b>Syllabus</b>			
Introduction to signals and systems – Discrete Fourier Transforms – Fast Fourier Transforms - Introduction to FIR and IIR systems - FIR filter design - Finite word length effects in digital Filters - Introduction to FDA Toolbox in MATLAB - Introduction to TMS320 Family - Design & Implementation and Filter Structures - Introduction to Code Composer Studio			
<b>Expected outcome .</b>			
The students will be able to:			
<ol style="list-style-type: none"> <li>Analyse DT systems with DFT</li> <li>Design digital filters IIR and FIR filters</li> <li>Analyse finite word length effects in signal processing</li> <li>Design filters using Matlab FDA tool box</li> <li>Understand Digital Signal Controllers and their Applications</li> </ol>			
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>Alan V.Oppenheim, Ronald W. Schafer &amp; Hohn. R.Back, “Discrete Time Signal Processing”, Pearson Education, 2nd edition, 2005.</li> <li>Emmanuel.C.Ifeachor, &amp; Barrie.W.Jervis, “Digital Signal Processing”, Second edition, Pearson Education / Prentice Hall, 2002.</li> <li>John G. Proakis &amp; Dimitris G.Manolakis, “Digital Signal Processing Principles, Algorithms &amp; Applications”, Fourth edition, Pearson education / Prentice Hall, 2007</li> </ol>			
<b>References:</b>			
<ol style="list-style-type: none"> <li>Johny R. Johnson, Introduction to Digital Signal Processing, PHI, 2006.</li> <li>P.P.Vaidyanathan, Multirate Systems &amp; Filter Banks, Prentice Hall, Englewood cliffs, NJ, 1993.</li> <li>S.K. Mitra, Digital Signal Processing, A Computer Based approach, Tata Mc GrawHill, 1998.</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	Sem. Exam Marks
I	Introduction to signals and systems - Discrete Fourier transform: Frequency domain sampling, Discrete Fourier transform (DFT): DFT pair, properties of DFT, frequency response analysis of signals using the DFT, circular convolution using DFT , linear filtering based on DFT Fast Fourier transform (FFT); Introduction, Radix -2 decimation in time FFT algorithm, Radix-2 decimation in frequency algorithm.	7	15%
II	Introduction to FIR and IIR systems : Structures for realization of discrete time systems – structures for FIR and IIR systems – signal flow graphs, direct-form, cascade-form, parallel form, lattice and transposed structures and linear Phase FIR filters.	7	15%
<b>FIRST INTERNAL EXAMINATION</b>			
III	Design of digital filters – general considerations – causality and its	7	15%

	implications, characteristics of practical frequency selective filters IIR filter design : Discrete time IIR filter (Butterworth and Chebyshev) from analog filter – IIR filter (LPF, HPF, BPF, BRF) design by Impulse Invariance, Bilinear transformation, Approximation of derivatives. filter design		
<b>IV</b>	FIR filter design : Structures of FIR filter- Linear phase FIR filter – Filter design using windowing techniques, frequency sampling techniques	7	15%
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	Finite word length effects in digital Filters : Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error – Round-off noise power - limit cycle oscillations due to product round-off and overflow errors - signal scaling <b>Introduction to FDA Toolbox in MATLAB: Design of filters using FDA toolbox (Demo/Assignment only)</b>	7	20%
<b>VI</b>	Introduction to TMS320 Family: Architecture, Implementation, C24x CPU Internal Bus Structure, Memory Central Processing unit , Memory and I/O Spaces , Overview of Memory and I/O Spaces, Program control Address Modes System Configuration and Interrupts clocks and low Power Modes Digital input / output (I/O), Assembly language Instruction , Instruction Set summary , Instruction Description, Accumulator, arithmetic and logic Instruction , Auxiliary Register and data page Pointer Instructions , TREG, PREG, and Multiply Instruction ,Branch Instructions , Control Instructions I/O and Memory Instruction <b>Design &amp; Implementation and Filter Structures: MATLAB functions and TMS320 Implementation (Demo/Assignment only)</b> <b>Introduction to Code Composer Studio (Demo only)</b>	7	20%
<b>END SEMESTER EXAM</b>			

**QUESTION PAPER PATTERN:**

Maximum Marks: 100

Exam Duration: 3Hours.

**Part A:** 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

**Part B:** 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

**Part C:** 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

**Part D:** 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.