

<b>Course Title: Digital Signal Processing Lab</b>	<b>Course Code: 20EC57L</b>
<b>Credits : 1.5</b>	<b>Total Contact Hours (L:T:P): 0:0:30</b>
<b>Type of Course: Laboratory</b>	<b>Category: Professional Core Course</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>

**Pre-requisite:** Signals and Systems, Digital Signal Processing

**Course Objective:** To make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and the importance of Signal Processors.

**Course Outcomes:** After completing this course, students should be able to

CO1:	Analyze and verify signal processing concepts and algorithms
CO2:	Design and demonstrate signal processing algorithms using simulation tool and/or Hardware platform

Exp t No.	Experiment Name	No. of Hours
1	Explore Digital Signal Processing Virtual Laboratory of Department of Electronics and Electrical Communication Engineering Indian Institute of Technology, Kharagpur <a href="http://www.digital.iitkgp.ernet.in/dsp/expts/index.php">http://www.digital.iitkgp.ernet.in/dsp/expts/index.php</a>	3
2	a) Write a MATLAB code to illustrate the Nyquist sampling theorem. The program should illustrate the effects the sampling the signal at <ul style="list-style-type: none"> <li>Exactly the folding frequency</li> <li>Frequency less than the folding frequency</li> <li>Frequency greater than the folding frequency</li> </ul> Plot the magnitude spectrum for all the above said cases b) Write a MATLAB code to compute the DTFT and DFT of a sequence $x(n)$ . Also plot the magnitude spectrum of both DTFT and DFT and provide the inference on the basis of results obtained. Further compute the IDTFT and IDFT.	3
3	Write a MATLAB code to verify the following properties of DFT <ol style="list-style-type: none"> <li>Linearity</li> <li>Periodicity</li> <li>Circular shift and Circular symmetry of a sequence</li> <li>Symmetry property</li> </ol>	3
4	Write a MATLAB code to verify the following properties of DFT <ol style="list-style-type: none"> <li>Circular convolution and multiplication of two sequences.</li> <li>Time reversal of a sequence.</li> <li>Circular time shift and Circular frequency shift of a sequence.</li> <li>Parseval's theorem.</li> </ol>	
5	Write a MATLAB code to compute the DFT of a sequence $x(n)$ using DIT and DIF algorithm. Also indicate the speed improvement factor in calculating the DFT of a sequence using direct computation and FFT algorithm (Use the same	3

	sequence as used in Program2).Further compute the IDFT using IDIT and IDIF algorithm.	
6	Write a MATLAB code to verify the Low pass and High Pass FIR linear phase filter design using Hamming and Hanning windows (with inbuilt and without using inbuilt commands). Plot the magnitude and phase response. Also, Provide the inference on the basis of results obtained for these to specifications. (To design should be verifiedmby convolving the input signal with the designed filter coefficients)	3
7	Write a MATLAB code to verify the Band pass and Band reject FIR linear phase filter design using Hamming and Hanning windows (with inbuilt and without using inbuilt commands). Plot the magnitude and phase response. Also, Provide the inference on the basis of results obtained for the set of specifications.	3
8	Write a MATLAB code to implement the Low pass Chebyshev (Type1) IIR filter design using bilinear transformation (BLT) method and Impulse Invariant Technique (IIT) method.	3
9	Write a MATLAB code to verify the Low pass Butterworth IIR filter design using bilinear transformation (BLT) method and Impulse Invariant Technique (IIT) method.	3
10	Write a MATLAB code to illustrate the effect of Decimation and Interpolation by an integer factor. Plot the magnitude spectrum. Design the necessary filter to overcome aliasing and image frequencies after decimating and inter-polating the signal respectively.	3
11	Read the data file named ecg2x60.datfrom <a href="http://people.ucalgary.ca/~ranga/enel563/SIGNAL_DATA_FILES/">http://people.ucalgary.ca/~ranga/enel563/SIGNAL_DATA_FILES/</a> That is corrupted with the 60Hz noise component. Write a MATLAB code to remove this 60Hz noise component from the signal using Notch filter and LMS adaptive filter. Plot the magnitude spectrum of the signal filtered using both Notch filter and LMS adaptive filter and provide the inference on the basis of results obtained.	3
<b>HardwareExperimentUsingTMS320C6713DSPKit</b>		
12	a) Write a C code to obtain the impulse response of a given system and implement the same on TMS320C6713 DSK-kit. b) Write a C code to compute the linear and circular convolution and implement the same on TMS320C6713 DSK-kit.	3
13	a) Write a C code to compute the cross-correlation and auto-correlation and implement the same on TMS320C6713 DSK-kit. b) Write a C code to compute N-point DFT and IDFT of a sequence and implement the same on TMS320C6713 DSK-kit.	3

### Reference Books:

1. **Sanjit K Mitra**,“*Digital Signal Processing Laboratory Using MATLAB*”, McGraw Hill International Edition, 2002.
2. **Vinay K Ingle and John G Proakis**,“*Digital Signal Processing Laboratory Using MATLAB*”, 3<sup>rd</sup> Edition, Cengage Learning, 2010.