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Note : Remove “Table of Content” before including in CP Book

# 17ECL57 : Digital Signal Processing Lab

## A. LABORATORY INFORMATION

### 1. Lab Overview

| | | | |
|---|---|---|---|
| *Degree:* | B.E | *Program:* | EC |
| *Year / Semester :* | 5 / 1 | *Academic Year:* | 2019-20 |
| *Course Title:* | Digital Signal Processing Lab | *Course Code:* | 17ECL57 |
| *Credit / L-T-P:* | 1+2 | *SEE Duration:* | 180 Minutes |
| *Total Contact Hours:* | 52 | *SEE Marks:* | 100 Marks |
| *CIA Marks:* | 40 | *Assignment* | 05 |
| *Course Plan Author:* | Nayana Hegde | *Sign* | Dt : |
| *Checked By:* | | *Sign* | Dt : |

### 2. Lab Content

| Unit | **Title of the Experiments** | **Lab Hours** | **Concept** | **Blooms Level** |
|---|---|---|---|---|
| 1 | Verification of sampling theorem | 3 | Reconstruction of signal | L4<br>Analyze |
| 2 | Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution | 3 | LTI response | L4 |
| 3 | Auto and cross correlation of two sequences and verification of their properties | 3 | Similarity analysis | L4 |
| 4 | Solving a given difference equation. | 3 | System analysis | L4 |
| 5 | Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine). | 3 | Frequency Response | L4 |
| 6 | Verification of DFT properties (like Linearity and Parseval's | 3 | Frequency | L4 |

| | | | | |
|---|---|---|---|---|
| | theorem, etc.) | | Response | |
| 7 | DFT computation of square pulse and Sinc function etc. | 3 | Frequency Response | L4 |
| 8 | Design and implementation of FIR filter to meet given specifications (using different window techniques). | 3 | FIR Filter | L4 |
| 9 | Design and implementation of IIR filter to meet given specifications. | 3 | IIR Filter | L4 |
| 10 | Linear convolution of two sequences | 3 | DSP Processor interfacing | L4 |
| 11 | Circular convolution of two sequences | 3 | | L4 |
| 12 | N-point DFT of a given sequence | 3 | | L4 |
| 13 | Impulse response of first order and second order system | 3 | | L4 |
| 14 | Implementation of FIR filter | 3 | | L4 |

## 3. Lab Material

| Unit | Details | Available |
|---|---|---|
| 1 | Text books | |
| 1 | Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007 | In Lib |
| | | |
| 2 | Reference books | |
| 1 | Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003 | In Lib |
| 2 | Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010. | n Lib |
| 3 | Digital Signal Processing, Lee Tan: Elsevier publications, 2007. | n Lib |
| 3 | Others (Web, Video, Simulation, Notes etc.) | |
| | | |
| | | |

## 4. Lab Prerequisites:

| - | - | Base Course: | | - | - |
|---|---|---|---|---|---|
| SNo | Course Code | Course Name | Topic / Description | Sem | Remarks |
| 1 | 17EC44 | Signals and systems | Knowledge on signals and systems | 4 | |
| 2 | 17MAT31 | Maths -III | Knowledge on Fourier transform | 3 | Plan Gap Course |
| | | | | | |
| | | | | | |
| | | | | | |

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

## 5. General Instructions

| SNo | Instructions | Remarks |
|---|---|---|
| 1 | Observation book and Lab record are compulsory. | |
| 2 | Students should report to the concerned lab as per the time table. | |
| 3 | After completion of the program, certification of the concerned staff in-charge in the observation book is necessary. | |
| 4 | Student should bring a notebook of 100 pages and should enter the readings /observations into the notebook while performing the experiment. | |
| 5 | The record of observations along with the detailed experimental procedure of the experiment in the Immediate last session should be submitted and certified staff member in-charge. | |
| 6 | Should attempt all problems / assignments given in the list session wise. | |
| 7 | It is responsibility to create a separate directory to store all the programs, so that nobody else can read or copy. | |
| 8 | When the experiment is completed, should disconnect the setup made by them, and should return all the components/instruments taken for the purpose. | |
| 9 | Any damage of the equipment or burn-out components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year | |
| 10 | Completed lab assignments should be submitted in the form of a Lab Record in which you have to write the algorithm, program code along with comments and output for various inputs given | |

## 6. Lab Specific Instructions

| SNo | Specific Instructions | Remarks |
|---|---|---|
| 1 | Start computer | |
| 2 | Open the text editor | |
| 3 | Select new file. | |
| 4 | Write the program | |
| 5 | Save the program with .m extension. | |
| 6 | Compile the program F9 | |
| 7 | Execute the program F5 | |

# B. OBE PARAMETERS

## 1. Lab / Course Outcomes

| # | COs | Teach. Hours | Concept | Instr Method | Assessment Method | Blooms' Level |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Verification of sampling theorem | 10 | Reconstruction of signal | Demonstrate | Slip Test | L4 |
| 2 | Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution | 06 | Linear Time Invariant (LTI) Response | Demonstrate | Assignment | L4 |
| 3 | Auto and cross correlation of two sequences and verification of their properties | 07 | Similarity analysis | Demonstrate | Assignment and Slip Test | L4 |
| 4 | Solving a given difference equation | 03 | Digital System Analysis | Simulation | Assignment | L4 |
| 5 | Computation of N point DFT of a given sequence and to<br>plot magnitude and phase spectrum | 03 | Frequency synthesis | Tutorial | Slip test | L4 |
| 6 | Verification of DFT properties | 03 | Frequency synthesis | Tutorial | Assignment | L4 |
| 7 | Design and implementation of FIR filter to meet given specifications | 03 | FIR filter design | Demonstrate | Assignment and Slip Test | L4 |
| 8 | Design and implementation of IIR filter to meet given specifications | 03 | IIR filter design | Demonstrate | Assignment | L4 |
| 9 | Linear convolution of two sequences using interfacing | 03 | Interfacing DSP processor | Demonstrate | Assignment | L4 |
| 10 | Circular convolution of two sequences | 03 | | Demonstrate | Assignment | L4 |
| 11 | N-point DFT of a given sequence | 03 | | Demonstrate | Assignment | L4 |
| 12 | Impulse response of first order and second order system | 03 | | Demonstrate | Assignment | L4 |
| 13 | Implementation of FIR | 03 | | Demonstrat | Assignment | L4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | filter | | | e | | |
| **-** | **Total** | **60** | **-** | **-** | **-** | **-** |

Note: Identify a max of 2 Concepts per unit. Write 1 CO per concept.

## 2. Lab Applications

| SNo | Application Area | CO | Level |
|---|---|---|---|
| 1 | A to D converter | CO1 | L4 |
| 2 | Statistics and probability | CO2 | L4 |
| 3 | Signal detection and pattern recognition | CO3 | L4 |
| 4 | Quantum mechanics and electrodynamics | CO4 | L4 |
| 5 | Frequency analysis and spectral analysis | CO5 | L4 |
| 6 | Frequency analysis and spectral analysis | CO6 | L4 |
| 7 | Signal selection using fir filter | CO7 | L4 |
| 8 | Signal selection using iir filter | CO8 | L4 |
| 9 | Radar,sonar and | CO9 | L4 |

Note: Write 1 or 2 applications per CO.

## 3. Articulation Matrix

**(CO – PO MAPPING)**

| – | Course Outcomes | Program Outcomes | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Level |
| 17ECL57.1 | Verification of sampling theorem | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.2 | Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.3 | Auto and cross correlation of two sequences and verification of their properties | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.4 | Solving a given difference equation | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.5 | Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.6 | Verification of DFT properties | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.7 | Design and implementation of FIR filter to meet given specifications | √ | √ | √ | | √ | | | | √ | | | | L4 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17ECL57.8 | Design and implementation of IIR filter to meet given | √ | √ | √ | | √ | | | | √ | | | | L4 |
| 17ECL57.9 | Introduction to dsp processor | √ | √ | √ | | √ | | | | | √ | | | L4 |
| | Average | | | | | | | | | | | | | |

Note: Mention the mapping strength as 1, 2, or 3

## 4. Mapping Justification

| Mapping | | Mapping Level | Justification |
|---|---|---|---|
| **CO** | **PO** | - | - |
| CO1 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO1 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO1 | PO3 | L4 | Design digital system components |
| CO1 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO1 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |
| CO2 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO2 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO2 | PO3 | L4 | Design digital system components |
| CO2 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO2 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |
| CO3 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO3 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO3 | PO3 | L4 | Design digital system components |
| CO3 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO4 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO4 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO4 | PO3 | L4 | Design digital system components |
| CO4 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO4 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |
| CO5 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO5 | PO2 | L4 | Identify, formulate and review complex engineering problems |

| | | | |
|---|---|---|---|
| CO5 | PO3 | L4 | Design digital system components |
| CO5 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO5 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |
| CO6 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO6 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO6 | PO3 | L4 | Design digital system components |
| CO6 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO6 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |
| CO7 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO7 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO7 | PO3 | L4 | Design digital system components |
| CO7 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO7 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |
| CO8 | PO1 | L4 | Applies basic mathematics and science knowledge for solution to engineering problems |
| CO8 | PO2 | L4 | Identify, formulate and review complex engineering problems |
| CO8 | PO3 | L4 | Design digital system components |
| CO8 | PO5 | L4 | Specific tool available for simulation and implementation |
| CO8 | PO9 | L4 | Applies to individual and team work for project, internship and miniproject |

Note: Write justification for each CO-PO mapping.

## 5. Curricular Gap and Content

| SNo | Gap Topic | Actions Planned | Schedule Planned | Resources Person | PO Mapping |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| | | | | | |
| | | | | | |

Note: Write Gap topics from A.4 and add others also.

## 6. Content Beyond Syllabus

| SNo | Gap Topic | Actions Planned | Schedule Planned | Resources Person | PO Mapping |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
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| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| | | | | | |
| | | | | | |

Note: Anything not covered above is included here.

## C. COURSE ASSESSMENT

### 1. Course Coverage

| Unit | Title | Teaching Hours | No. of question in Exam | | | | | | | CO | Levels |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CIA-1 | CIA-2 | CIA-3 | Asg-1 | Asg-2 | Asg-3 | SEE | | |
| 1 | | 03 | 1 | - | - | - | - | - | 1 | CO1 | L4 |
| 2 | | 03 | 1 | - | - | - | - | - | 1 | CO2 | L4 |
| 3 | | 03 | 1 | - | - | - | - | - | 1 | CO3 | L4 |
| 4 | | 03 | 1 | - | - | - | - | - | 1 | CO4 | L4 |
| 5 | | 03 | - | 1 | - | - | - | - | 1 | CO5 | L4 |
| 6 | | 03 | - | 1 | - | - | - | - | 1 | CO6 | L4 |
| 7 | | 03 | - | 1 | - | - | - | - | 1 | CO7 | L4 |
| 8 | | 03 | - | 1 | - | - | - | - | 1 | CO8 | L4 |
| 9 | | 03 | - | 1 | - | - | - | - | 1 | CO9 | L4 |
| 10 | | 03 | - | - | 1 | - | - | - | 1 | CO10 | L4 |
| 11 | | 03 | - | - | 1 | - | - | - | 1 | CO11 | L4 |
| 12 | | 03 | - | - | 1 | - | - | - | 1 | CO12 | L4 |
| 13 | | 03 | - | - | 1 | - | - | - | 1 | CO13 | L4 |
| **-** | **Total** | **60** | **7** | **8** | **5** | **5** | **5** | **5** | **20** | **-** | **-** |

Note: Write CO based on the theory course.

## 2. Continuous Internal Assessment (CIA)

| Evaluation | Weightage in Marks | CO | Levels |
|---|---|---|---|
| CIA Exam – 1 | 30 | CO1, CO2, CO3, CO4 | L23, L3 |
| CIA Exam – 2 | 30 | CO5, CO6, CO7, | L1, L2, L3 . . |
| CIA Exam – 3 | 30 | CO8, CO9 | L1, L2, L3 . . |
| | | | |
| Assignment – 1 | 05 | CO1, CO2, CO3, CO4 | L2, L3, L4 ... |
| Assignment – 2 | 05 | CO5, CO6, CO7, CO8, CO9 | L1, L2, L3 ... |
| Assignment – 3 | 05 | CO8, CO9 | L1, L2, L3 ... |
| | | | |
| Seminar – 1 | 05 | CO1, CO2, CO3, CO4 | L2, L3, L4 . .. |
| Seminar – 2 | 05 | CO5, CO6,CO7,CO8, CO9 | L2, L3, L4 . .. |
| Seminar – 3 | 05 | CO8, CO9 | L2, L3, L4 . .. |
| | | | |
| Other Activities – define – Slip test | | CO1 to Co9 | L2, L3, L4 . .. |
| **Final CIA Marks** | **40** | **-** | **-** |

–

| SNo | Description | Marks |
|---|---|---|
| 1 | Observation and Weekly Laboratory Activities | 05 Marks |
| 2 | Record Writing | 10 Marks for each Expt |
| 3 | Internal Exam Assessment | 25 Marks |
| 4 | Internal Assessment | 40 Marks |
| 5 | SEE | 600 Marks |
| - | **Total** | **100 Marks** |

## D. EXPERIMENTS

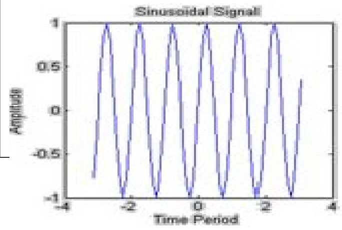
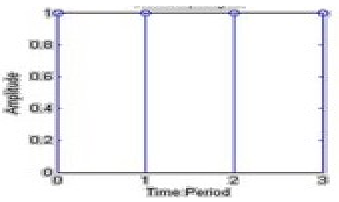
### Experiment 01 : Verification of sampling Theorem

| - | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducte** | |
|---|---|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| | | d |
| 1 | Title | Verification of sampling theorem |
| 2 | Course Outcomes | Reconstruction of the signal |
| 3 | Aim | Verification of sampling theorem. |
| 4 | Material / Equipment Required | Lab Manual |
| 5 | Theory, Formula, Principle, Concept | Nyquist rate |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | • step 1: start<br>• step 2: write programming<br>• step 3: save the program<br>• step 4: compile<br>• step 5:if error then correct the errors<br>• step 6:run<br>• step 7:stop |
| | Program | |

```
clc;
clear all;
t = 0:0.001:1;
fm = input('Enter the modulating signal frequency = ');
x = sin(2*pi*fm*t);
subplot(4,2,1);
plot(t,x);
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Message Signal');
fs1 = input('Enter Sampling Frequency < Modulating Signal Frequency = ');
fs2 = input('Enter Sampling Frequency = Modulating Signal Frequency = ');
fs3 = input('Enter Sampling Frequency > Modulating Signal Frequency = ');
%Sampling at fs<<2fm
n = 0:1/fs1:1;
x1 = sin(2*pi*fm*n);
subplot(4,2,2);
stem(n,x1);
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Undersampled fs<<2fm Signal');
subplot(4,2,3);
plot(n,x1);
```

```
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Reconstructed Undersampled fs<<2fm Signal');
%Sampling at fs=2fm
n = 0:1/fs2:1;
x2 = sin(2*pi*fm*n);
subplot(4,2,4);
stem(n,x2);
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Sampled at Nyquist Rate fs=2fm Signal');
subplot(4,2,5);
plot(n,x2);
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Reconstructed Nyquist Rate fs=2fm Signal');
%Sampling at fs>>2fm
n = 0:1/fs3:1;
x3 = sin(2*pi*fm*n);
subplot(4,2,6);
stem(n,x3);
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Oversampled fs>>2fm Signal');
subplot(4,2,7);
plot(n,x3);
xlabel('Time ----->');
ylabel('Amplitude ----->');
title('Reconstructed Oversampled fs>>2fm Signal');
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | • –<br>• –<br>• – |
| 8 | Observation Table, Look-up Table, Output | •<br>• |
| 9 | Sample Calculations | • –<br>• –<br>• – |
| 10 | Graphs, Outputs |   |

| | | |
|---|---|---|
| | | |
| 11 | Results & Analysis | • –<br>• – |
| 12 | Application Areas | • Analog to Digital Converter |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

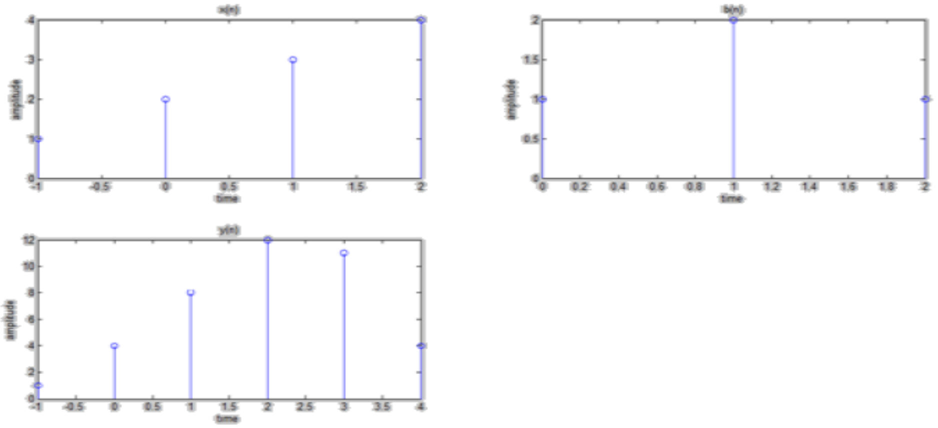
## Experiment 02 /;Linear and Circular convolution

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Linear and circular convolution | | | | | | |
| 2 | Course Outcomes | Convolution | | | | | | |
| 3 | Aim | Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution. | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | Multiply and add | | | | | | |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step 1: start<br>Step 2: Assign the variables to the input sequence and impulse sequence.<br>Step 3: Assign the lower and upper limits for both input and impulse sequence<br>Step 4: Perform convolution using the function 'conv'<br>Step 5: Give the x label and y label and title it. Save and run the program<br>step 6: stop | | | | | | |

Program

```
x=input('enter the sequence for x(n):')
h=input('enter the sequence for h(n):')
u1=input('enter the upper limit for x(n):')
l1=input('enter the lower limit for x(n):')
u2=input('enter the upper limit for h(n):')
l2=input('enter the lower limit for h(n):')
a=l1:1:u1
subplot(2,2,1);
stem(a,x);
xlabel('time');
ylabel('amplitude');
```

```
title('x(n)');
b=l2:1:u2;
subplot(2,2,2);
stem(b,h);
xlabel('time');
ylabel('amplitude');
title('b(n)');
y=conv(x,h);
c=(l1+l2):1:(u1+u2);
subplot(2,2,3);
stem(c,y);
xlabel('time');
ylabel('amplitude'
title('y(n)');
```

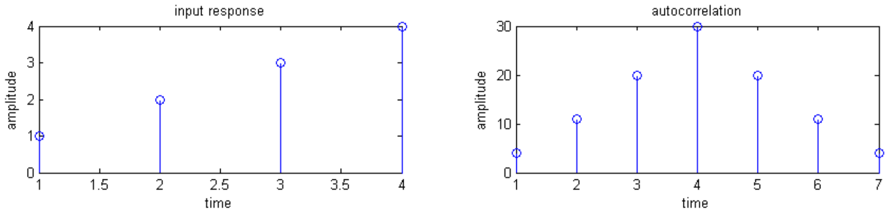
| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs |  |
| 11 | Results & Analysis | |
| 12 | Application Areas | Probability and statistics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

# Experiment 03 /;Auto correlation and cross correlation

<table>
<tr><th>-</th><th>Experiment No.:</th><th>1</th><th>Marks</th><th></th><th>Date Planned</th><th></th><th>Date Conducted</th><th></th></tr>
<tr><td>1</td><td>Title</td><td colspan="7">Auto correlation and cross correlation</td></tr>
<tr><td>2</td><td>Course Outcomes</td><td colspan="7">Similarity Analysis of two discrete sequences</td></tr>
<tr><td>3</td><td>Aim</td><td colspan="7">Auto and cross correlation of two sequences and verification of their properties</td></tr>
<tr><td>4</td><td>Material / Equipment Required</td><td colspan="7">Lab Manual</td></tr>
<tr><td>5</td><td>Theory, Formula, Principle, Concept</td><td colspan="7">Compare the sequences</td></tr>
<tr><td>6</td><td>Procedure, Activity, Algorithm, Pseudo Code</td><td colspan="7">Step 1: start<br>Step 2: read first discrete sequence<br>Step 3: read second discrete sequence<br>Step 4: compare<br>Step 5: print the result<br>step 6: stop</td></tr>
</table>

Program

```
x= input (‘Enter any sequence’);
subplot(3,2,1);
stem(x);
xlabel(‘Time period’);
ylabel(‘Amplitude’);
title(‘Input sequence’);
y=xcorr(x);
subplot(3,2,2);
xlabel(‘Time period’);
ylabel(‘Amplitude’);
title(‘Auto correlation’);
x=input(‘Enter any sequence’);
subplot(3,2,1);
stem(x);
xlabel(‘Time period’);
ylabel(‘Amplitude’);
title(‘Input sequence’);
h=input(‘Enter any sequence’);
subplot(3,2,2);
stem(h);
xlabel(‘Time period’);
ylabel(‘Amplitude’);
```

| | | |
|---|---|---|
| | | title('Impulse sequence');<br>y=xcorr(x,h);<br>subplot(3,2,3);<br>stem(y);<br>xlabel('Time period');<br>ylabel('Amplitude');<br>title('Cross correlation'); |
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs |  |
| 11 | Results & Analysis | |
| 12 | Application Areas | Signal detection and pattern recognition |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 04 /;Difference equation

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Difference equation | | | | | | |
| 2 | Course Outcomes | System design | | | | | | |
| 3 | Aim | Solving a given difference equation | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | Calculating impulse response of the system | | | | | | |

**6 Procedure, Activity, Algorithm, Pseudo Code**

```
Step 1: start
Step 2: read input sequence
Step 3: calculate impulse response
Step 4: find out system coefficients
Step 5: print the result
step 6: stop
```

**Program**

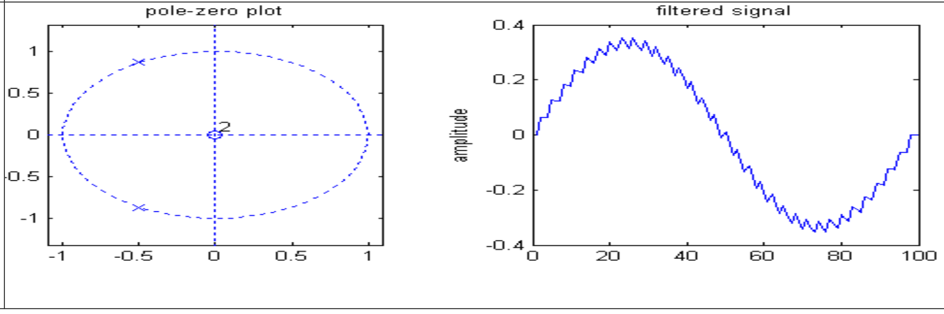
```
a=input('enter the input');
b=input('enter the input');
x=linspace(0,2*pi,100);
y=sin(x);
subplot(2,3,1);
plot(y);
xlabel('time period');
ylabel('amplitude');
title('sine wave');
e=rand(size(x));
subplot(2,3,2);
plot(e);
xlabel('time period');
ylabel('amplitude');
title('noise signal');
subplot(2,3,3);
t=y+e;
plot(x,t);
xlabel('time period');
y(n)+y(n-1)+y(n-2)=x(n)
```

**7 Block, Circuit, Model Diagram, Reaction Equation, Expected Graph**

**8 Observation Table, Look-up Table, Output**

**9 Sample Calculations**

**10 Graphs, Outputs**

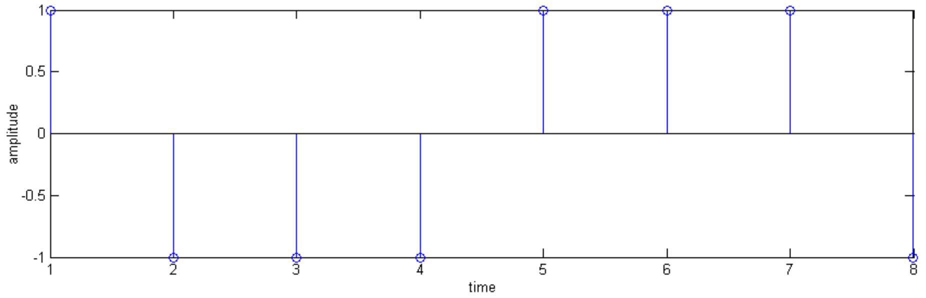


| | | |
|---|---|---|
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 05 /;Discrete Fourier transform

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Discrete Fourier transform | | | | | | |
| 2 | Course Outcomes | Frequency synthesis | | | | | | |
| 3 | Aim | Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | Calculating impulse response of the system | | | | | | |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step 1: start<br>Step 2: read input sequence<br>Step 3: calculate impulse response<br>Step 4: find out system coefficients<br>Step 5: print the result<br>step 6: stop | | | | | | |
| | Program | PROGRAM: (Spectrum Analysis Using DFT) | | | | | | |

```
N=input('type length of DFT= ');
T=input('type sampling period= ');
freq=input('type the sinusoidal freq= ');
k=0:N-1;
f=sin(2*pi*freq*1/T*k);
F=fft(f);
stem(k,abs(F));
grid on;
xlabel('k');
ylabel('X(k)');
INPUT:
type length of DFT=32
type sampling period=64
type the sinusoidal freq=11
```

| | | |
|---|---|---|
| | | |
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs |  |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 06 /; Verificationof DFT Properties

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Verification of DFT properties | | | | | | |
| 2 | Course Outcomes | Frequency synthesis | | | | | | |
| 3 | Aim | Verification of DFT properties | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | Linearity and Parseval's theorem | | | | | | |
| 6 | Procedure, Activity, | Step 1: start<br>Step 2: read input sequence | | | | | | |

| | | |
|---|---|---|
| | Algorithm, Pseudo Code | Step 3: calculate impulse response<br>Step 4: find out system coefficients<br>Step 5: print the result<br>step 6: stop |
| | Program | PROGRAM: (Spectrum Analysis Using DFT) |

```
N=input('type length of DFT= ');
T=input('type sampling period= ');
freq=input('type the sinusoidal freq= ');
k=0:N-1;
f=sin(2*pi*freq*1/T*k);
F=fft(f);
stem(k,abs(F));
grid on;
xlabel('k');
ylabel('X(k)');
INPUT:
type length of DFT=32
type sampling period=64
type the sinusoidal freq=11
```

OUTPUT: (Spectrum Analysis Using DFT)

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs | |

```
Enter the x sequence ==>[2 4 6 8]
 Enter the h sequence ==>[10 3 5 2 5 7]
ftx =  Columns 1 through 4   20.0000             2.1061 -15.4082i  -6.9436 + 0.9369i    5.0000 + 1.7321i  Columns 5 through 8   -1.1625 - 4.4396i  -1.1625 + 4.4396i    5.0000 - 1.7321i   -6.9436 - 0.9369i   Column 9   2.1061 +15.4082i
```

| | | |
|---|---|---|
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

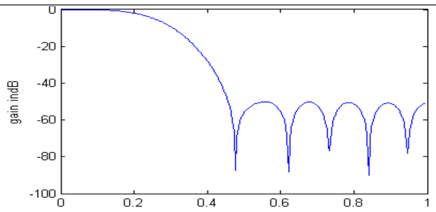
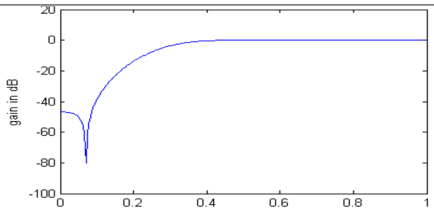
# Experiment 07 /; Design and Implementation of FIR filter

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Design and Implementation of FIR filter | | | | | | |
| 2 | Course Outcomes | Design and Implementation of FIR filter | | | | | | |
| 3 | Aim | Design and Implementation of FIR filter | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | Window Technique | | | | | | |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step 1: Assign the variable for pass band ripple ,stop band ripple, pass band and stop<br>Step 2 :band frequency Determine the order of filter using the required formula.<br>Step 3 :Find the filter co-efficient b<br>Step 4 :Assign the time and amplitude Plot the magnitude and phase angle for LPF.HPF,BPF&BSF.<br>Step 5 : Give the x label and y label and title it | | | | | | |
| | Program | | | | | | | |

```
%Hamming window%
rp=input('enter the PB ripple');
rs=input('enter the SB ripple');
fp=input('enter PB frequency');
fs=input('enter SB frequency');
f=input('enter sampling frequency');
wp=2*(fp/f);
ws=2*(fs/f);
num=-20*log10(sqrt(rp*rs))-13;
den=14.6*(fs-fp)/f;
n=ceil(num/den);
n1=n+1;
if(rem(n,2)~=0);
n1=n;
n=n-1;
end;
y=hamming(n1);
%LPF
b=fir1(n,wp,y);
[h,o]=freqz(b,1,256);
M=20*log10(abs(h));
subplot(2,2,1);
```

```
plot(o/pi,M);
ylabel('gain indB');
xlabel('(a) normal frequency');
%HPF
b=fir1(n,wp,'high',y );
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,2);
plot(o/pi,m);
ylabel('gain in dB');
xlabel('(b) normal frequency');
%BPF
wn=[wp,ws];
b=fir1(n,wn,y);
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,3);
plot(o/pi,m);
ylabel('gain in dB');
xlabel('(c) normal frequency');
%BSF
b=fir1(n,wn,'stop',y);
[h,o]=freqz(b,1,256);
m=20*log10(abs(h));
subplot(2,2,4);
plot(o/pi,m);
ylabel('gain in dB')

Enter the PB ripple: 0.05
Enter the SB ripple: 0.04
Enter PB frequency: 1200
Enter SB frequency: 1700
Enter sampling frequency: 9000
.
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |

|  |  |  |
|---|---|---|
| 10 | Graphs, Outputs |   |
| 11 | Results & Analysis |  |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks |  |
| 14 | Faculty Signature with Date |  |

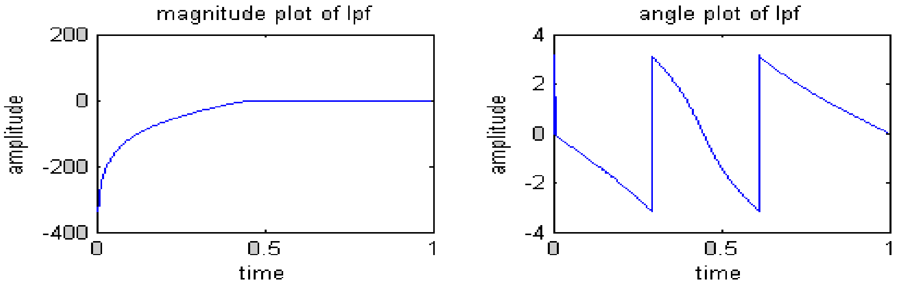
## Experiment 08 /; Design and Implementation of IIR filter

| – | **Experiment No.:** | 1 | **Marks** |  | **Date Planned** |  | **Date Conducted** |  |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Design and Implementation of IIR filter |  |  |  |  |  |  |
| 2 | Course Outcomes | Design and Implementation of IIR filter |  |  |  |  |  |  |
| 3 | Aim | Design and Implementation of IIR filter |  |  |  |  |  |  |
| 4 | Material / Equipment Required | Lab Manual |  |  |  |  |  |  |
| 5 | Theory, Formula, Principle, Concept | For Given specifications |  |  |  |  |  |  |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step1: Start the mat lab software<br>Step2: Assign the variable for pass band ripple ,stop band ripple, pass band and stop band frequency<br>Step3: Determine the order of filter using the required formula.<br>Step4: Find the filter co-efficient a and b<br>Step5: Assign the time and amplitude<br>Step6: Plot the magnitude and phase angle.<br>Step7: Give the x label and y label and title it<br>Step8: Save and run the program |  |  |  |  |  |  |

Program

```
%LPF%
rp=input('enter the pass band ripple');
rs=input('enter the stop band ripple');
wp=input('enter the pass band frequency');
ws=input('enter the stop band frequency');
fs=input('enter the sampling frequency');
w1=2*(wp/fs);
```

```
w2=2*(ws/fs);
[n,wn]=cheb1ord(w1,w2,rp,rs);
[b,a]=cheby1(n,rp,wn);
w=0:0.01/pi:pi;
[h,om]=freqz(b,a,w);
m=20*log10(abs(h));
an=angle(h);
subplot(2,2,1);
plot((om/pi),m);
xlabel('time');
ylabel('amplitude');
title('magnitude plot of lpf');
subplot(2,2,2);
plot((om/pi),an);
xlabel('time');
ylabel('amplitude');
title('angle plot of lpf');
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs |  |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 08 /; Linear Convolution using DSP Kit

| - | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| 1 | Title | Verify linear convolution using Simulator and DSP Kit |
| 2 | Course Outcomes | LTI Response |
| 3 | Aim | Verification of linear convolution using Simulator and DSP Kit |
| 4 | Material / Equipment Required | Lab Manual |
| 5 | Theory, Formula, Principle, Concept | For Given specifications |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step1: Start the editor<br>Step 2:type the program<br>Step 3: Save program in .c extension<br>Step 4: Save and run the program<br>Step 5: convert into machine level code<br>Step 6 : Connect DSP Kit and observe waveforms |
| | Program | |

```
#include<stdio.h>
void main()
{
        int m=4;
        int n=4;
        int i,j;
        int x[10]={1,2,3,4,0,0,0,0};
        int h[10]={1,2,3,4,0,0,0,0};
        int y[10];

        for(i=0;i<(m+n+-1);i++)
        {
                y[i]=0;
                for(j=0;j<=i;j++)
                {
                        y[i]+=x[j]*h[i-j];
                }
        }
        printf("Linear Convolution Output ==>\n\n");
        for(i=0;i<(m+n-1);i++)
        {
                printf(" ==> %d\n",y[i]);
        }
}
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, | |

| | | |
|---|---|---|
| | Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs | Y =2 12 34 73 100 96 63 |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 10 /; Circular Convolution using DSP Kit

| - | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Verify Circular Convolution using DSP Kit | | | | | | |
| 2 | Course Outcomes | LTI Response | | | | | | |
| 3 | Aim | Verify Circular Convolution using DSP Kit | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | For Given specifications | | | | | | |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step1: Start the editor<br>Step 2: Type the program<br>Step 3: Save program in .c extension<br>Step 4: Save and run the program<br>Step 5: convert into machine level code<br>Step 6 : Connect DSP Kit and observe waveforms | | | | | | |
| | Program | | | | | | | |

```
#include<stdio.h>

void main()
{
        int x[20],y[20],h[20];
        int cirmat[20][20];
        int circnv[20];
        int i,j,k,m,n;
```

```
clrscr();

printf("\n\nEnter the length of x & y Sequence ==> ");
scanf("%d",&n);

printf("\n\nEnter the x Sequence ==>\n ");
for(i=0;i<n;i++)
{
        printf("\n===> ");
        scanf("%d",&x[i]);
}

printf("\n\nEnter the y Sequence ==>\n ");
for(i=0;i<n;i++)
{
        printf("\n===> ");
        scanf("%d",&y[i]);
}

h[0]=y[0];
j=1;
for(i=n-1;i>0;i--)
{
        h[j]=y[i];
        j++;
}

for(i=0;i<1;i++)
        for(j=0;j<n;j++)
                cirmat[i][j]=h[j];
k=n-1;

for(i=1;i<n;i++)
{
        cirmat[i][0]=h[k];
        for(j=0;j<n;j++)
        {
                cirmat[i][j+1]=cirmat[i-1][j];
        }
        k=k-1;
}
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, | |

| | | |
|---|---|---|
| | Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs | Enter X Sequence ==>[2 4 6 8]<br>Enter Y Sequence ==>[12 14 5 7 8]<br><br>Circular Convoluted Sequence ==> 138 180 202 214 186 |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 11 /; N-point DFT of a given sequence using DSP Kit

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| - | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |

| | | |
|---|---|---|
| 1 | Title | N-point DFT of a given sequence |
| 2 | Course Outcomes | Frequency Synthesis |
| 3 | Aim | Verify N-point DFT of a given sequence using DSP Kit |
| 4 | Material / Equipment Required | Lab Manual |
| 5 | Theory, Formula, Principle, Concept | For Given specifications |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step1: Start the editor<br>Step 2: Type the program<br>Step 3: Save program in .c extension<br>Step 4: Save and run the program<br>Step 5: convert into machine level code<br>Step 6 : Connect DSP Kit and observe wave forms |

Program

```
#include<stdio.h>
#include<math.h>
void main()
{
        float xi[32],xr[32],yi[64],yr[64];
        float Wn,PHI,cs,sn;
```

```
float vr1,vr2,vi1,vi2,tmp;
int i,j,n;

printf("Enter the size of the Sequence ==> ");
scanf("%d",&n);

printf("Enter the Values");
for(i=0;i<n;i++)
{
        printf("\n==> x[%d] <==",i);
        scanf("%f",&xr[i]);
}
for(i=0.0;i<n;i++)
{
        xi[i]=0.0;
}
for(i=0.0;i<(2*n);i++)
{
        yi[i]=0.0;
        yr[i]=0.0;
}
Wn=(float)6.2831853/n;
for(i=0;i<n;i++)
{
        PHI=Wn*(i);
        cs=cos(PHI);
        sn=sin(PHI);
        vi1=0.0;
        vi2=0.0;
        vr1=0.0;
        vr2=0.0;
        for(j=0;j<n;j++)
        {
           vi1=0.0;

                tmp=vr1;
                vr1=(2*cs*vr1) - (vr2+xr[j]);
                vr2=tmp;
                tmp=vi1;
                vi1=(2*cs*vi1) - (vi2+xi[j]);
                vi2=tmp;
        }
yr[i]=cs * vr1 - vr2 - sn * vi1;
```

```
        yi[i]=cs * vi1 - vi2 + sn * vr1;
    }
    for(i=0;i<n;i++)
        {
                printf("\n==> Real y[%d]   ==> R %f J %f ",i,yr[i],yi[i]);
        }
}
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs | Enter the x sequence ==>[4 6 8 9]<br>y =27.0000  -4.0000 + 3.0000i -3.0000 -4.0000 - 3.0000i<br>mag=27 5 3<br>pha = 0.4981 3.1416 -2.4981 |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 11 /; N-point DFT of a given sequence using DSP Kit

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| 1 | Title | N-point DFT of a given sequence |
| 2 | Course Outcomes | Frequency Synthesis |
| 3 | Aim | Verify N-point DFT of a given sequence using DSP Kit |
| 4 | Material / Equipment Required | Lab Manual |
| 5 | Theory, Formula, Principle, Concept | For Given specifications |
| 6 | Procedure, | Step1: Start the editor |

| | | |
|---|---|---|
| | Activity, Algorithm, Pseudo Code | Step 2: Type the program<br>Step 3: Save program in .c extension<br>Step 4: Save and run the program<br>Step 5: convert into machine level code<br>Step 6 : Connect DSP Kit and observe wave forms |
| | Program | |

```
#include<stdio.h>
#include<math.h>
void main()
{
        float xi[32],xr[32],yi[64],yr[64];
        float Wn,PHI,cs,sn;
        float vr1,vr2,vi1,vi2,tmp;
        int i,j,n;

        printf("Enter the size of the Sequence ==> ");
        scanf("%d",&n);

        printf("Enter the Values");
        for(i=0;i<n;i++)
        {
                printf("\n==> x[%d] <==",i);
                scanf("%f",&xr[i]);
        }
        for(i=0.0;i<n;i++)
        {
                xi[i]=0.0;
        }
        for(i=0.0;i<(2*n);i++)
        {
                yi[i]=0.0;
                yr[i]=0.0;
        }
        Wn=(float)6.2831853/n;
        for(i=0;i<n;i++)
        {
                PHI=Wn*(i);
                cs=cos(PHI);
                sn=sin(PHI);
                vi1=0.0;
                vi2=0.0;
                vr1=0.0;
                vr2=0.0;
                for(j=0;j<n;j++)
```

```
                        {
                            vi1=0.0;

                                    tmp=vr1;
                                    vr1=(2*cs*vr1) - (vr2+xr[j]);
                                    vr2=tmp;
                                    tmp=vi1;
                                    vi1=(2*cs*vi1) - (vi2+xi[j]);
                                    vi2=tmp;
                        }
            yr[i]=cs * vr1 - vr2 - sn * vi1;
            yi[i]=cs * vi1 - vi2 + sn * vr1;
    }
    for(i=0;i<n;i++)
            {
                        printf("\n==> Real y[%d]   ==> R %f J %f ",i,yr[i],yi[i]);
            }
}
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs | Enter the x sequence ==>[4 6 8 9]<br>y =27.0000  -4.0000 + 3.0000i -3.0000 -4.0000 - 3.0000i<br>mag=27 5 3<br>pha = 0.4981 3.1416 -2.4981 |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 12 /; Impulse response of first order and second order system using DSP Kit

| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Impulse response of first order and second order system | | | | | | |
| 2 | Course Outcomes | System Analysis | | | | | | |
| 3 | Aim | Impulse response of first order and second order system using DSP Kit | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | For Given specifications | | | | | | |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step1: Start the editor<br>Step 2: Type the program<br>Step 3: Save program in .c extension<br>Step 4: Save and run the program<br>Step 5: convert into machine level code<br>Step 6 : Connect DSP Kit and observe wave forms | | | | | | |

Program

```
#include<stdio.h>
#include<math.h>
void main()
{
        float h[10];
        int m,n;

        printf("Enter the value of N");
        scanf("%d",&m);

        for(n=0;n<m;n++)
        {
                h[n]=((2.0/3.0)*(pow(0.5,n))+(1.0/3.0)*(pow(0.25,n)));
        }

        printf(" Impulse Response Output ==> \n");

        for(n=0;n<m;n++)
        {
                printf("\n ==> %f",h[n]);
        }
}
```

| | | |
|---|---|---|
| 7 | Block, Circuit, | |

| | | |
|---|---|---|
| | Model Diagram, Reaction Equation, Expected Graph | |
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs | The impulse response is:<br>Columns 1 through 8 1.0000 0.4167 0.1875 0.0885 0.0430 0.0212 0.0105 0.0052Columns 9 through 12 0.0026 0.0013 0.0007 0.000 |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |

## Experiment 13 /; Implementation of FIR filter using DSP Kit

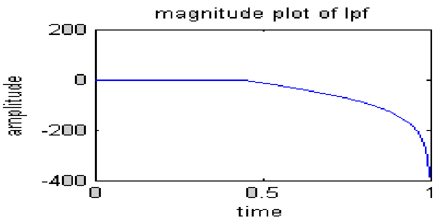
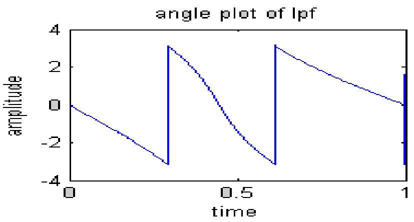
| – | **Experiment No.:** | 1 | **Marks** | | **Date Planned** | | **Date Conducted** | |
|---|---|---|---|---|---|---|---|---|
| 1 | Title | Implementation of FIR filter using DSP Kit | | | | | | |
| 2 | Course Outcomes | FIR Filter design | | | | | | |
| 3 | Aim | Implementation of FIR filter using DSP Kit | | | | | | |
| 4 | Material / Equipment Required | Lab Manual | | | | | | |
| 5 | Theory, Formula, Principle, Concept | For Given specifications | | | | | | |
| 6 | Procedure, Activity, Algorithm, Pseudo Code | Step1: Start the editor<br>Step 2: Type the program<br>Step 3: Save program in .c extension<br>Step 4: Save and run the program<br>Step 5: convert into machine level code<br>Step 6 : Connect DSP Kit and observe wave forms | | | | | | |

Program

```
#include<stdio.h>
#include<math.h>

void main()
{
        float sg[200],i;
        long float y[200];
```

```
        int j;
        float h[31]={0.0043,0.0050,0.0067,0.0096,0.0135,0.0183,
                     0.0237,0.0297,0.0358,0.0419,0.0477,0.0528,
                     0.0571,0.0603,0.0623,0.0629,0.0623,0.0603,
                     0.0571,0.0528,0.0477,0.0419,0.0358,0.0297,
                     0.0237,0.0183,0.0135,0.0096,0.0067,0.0050,
                     0.0043};
        float sum;
        int m,n,k,ord;


        ord=30;
        j=0;

        for(i=0.0;i<=0.1;i+=0.001)
        {
                sg[j]=(sin(2.0*3.14*10.0*i)+(0.5*sin(2.0*3.14*100.0*i)));
                printf("\n ==> %f",sg[j]);
                j++;
        }
        for(n=0;n<=100;n++)
        {
                sum=0.0;
                for(k=0;k<=ord;k++)
                {
                        if((n-k)>=0)
                        {
                                sum=(float)sum+h[k]*sg[n-k];
                        }
                }
                y[n]=sum;
        }

        for(k=0;k<10;k++)
        {
                printf("\ny[%d] ==> %f",k,y[k]);
        }

}
```

| | | |
|---|---|---|
| 7 | Block, Circuit, Model Diagram, Reaction Equation, Expected Graph | |

| | | |
|---|---|---|
| 8 | Observation Table, Look-up Table, Output | |
| 9 | Sample Calculations | |
| 10 | Graphs, Outputs |   |
| 11 | Results & Analysis | |
| 12 | Application Areas | Quantum mechanics and electrodynamics |
| 13 | Remarks | |
| 14 | Faculty Signature with Date | |