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Note : Remove "Table of Content" before including in CP Book

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

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

3. Lab Material

Unit	Details	Available
1	Text books	
	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	Course Name	Topic / Description	Sem	Remarks
	Code				
1	17EC44	Signals and	Knowledge on signals and systems	4	
		systems			
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.

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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.	Concept	Instr	Assessment	Blooms'
		Hours		Method	Method	Level

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ANGALOR		Course Lab M	Ianual			Page: 5 / 30	5
1	7. cAAS. All rights reserv Verification o theorem	^{ed.} f sampling		Reconstruction o signal	fDemonstrat e	Slip Test	L4
	Linear and convolution of sequences, Co distributive associative p convolution	f two given	06	Linear Time Invariant (LTI) Response	Demonstrat e	Assignment	L4
3	Auto and cros	s correlation iences and of their	07	Similarity analysis	Demonstrat e	Assignment and Slip Test	L4
	Solving a give equation	n difference	03	Digital System Analysis	Simulation	Assignment	L4
	Computation DFT of a give and to plot magnitude spectrum	en sequence	03	Frequency synthesis	Tutorial	Slip test	L4
	Verification properties	of DFT	03	Frequency synthesis	Tutorial	Assignment	L4
	Design implementation filter to m specifications	and n of FIR neet given	03	FIR filter design	Demonstrat e	Assignment and Slip Test	L4
8	Design implementation to meet specifications		03	llR filter design	Demonstrat e	Assignment	L4
	Linear convolu sequences interfacing	ition of two using	03	Interfacing DSP processor	Demonstrat e	Assignment	L4
	Circular conv two sequences		03		Demonstrat e	Assignment	L4
	N–point DFT sequence	of a given	03		Demonstrat e	Assignment	L4
	Impulse respo order and se system		03		Demonstrat e	Assignment	L4
13	Implementatio	n of FIR	03		Demonstrat	Assignment	L4

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	inter			e		
-	Total	60	-	-	-	-
Noto: Idor	tifus may of 2 Concepts n	or undit W	rita 1 CO nar concor	+		

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	C07	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	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	Level
		1	2	3	4	5	6	7	8	9	10	11	12	
17ECL57.1	Verification of sampling theorem	\checkmark	\checkmark	\checkmark		\checkmark				\checkmark				L4
17ECL57.2	Linear and circular convolution	\checkmark	√	\checkmark		\checkmark				\checkmark				L4
	of two given sequences,													
	Commutative,													
	distributive and associative													
	property of convolution													
17ECL57.3	Auto and cross correlation of	V	√	√		√				\checkmark				L4
	two sequences and verification													
	of their properties													
17ECL57.4	Solving a given difference	\checkmark	√	\checkmark		\checkmark				\checkmark				L4
	equation													
17ECL57.5	Computation of N point DFT of a	\checkmark	√	√		√				\checkmark				L4
	given sequence and to													
	plot magnitude and phase													
	spectrum													
17ECL57.6	Verification of DFT properties	\checkmark	√	\checkmark		\checkmark				\checkmark				L4
17ECL57.7	Design and implementation of	V	√	√		√				\checkmark				L4
	FIR filter to meet given													
	specifications													

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17ECL57.8	Design and	implementation of	f√	√	√		\checkmark			√				L4	
	llR filter to n	neet given													
17ECL57.9	Introduction	to dsp processor	\checkmark	√	\checkmark		\checkmark				\checkmark			L4	
	Average														

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

4. Mapping Justification

Mapping		Mapping	Justification
		Level	
СО	РО	-	-
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

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CO5	PO3	L4	Design digital system components							
CO5	PO5	L4	Specific tool available for simulation and impleme	ntation						
CO5	PO9	L4	Applies to individual and team work for project, ir miniproject	iternship and						
CO6	PO1	L4	Applies basic mathematics and science knowledge engineering problems	pplies basic mathematics and science knowledge for solution to ngineering problems						
CO6	PO2	L4	entify, formulate and review complex engineering problems							
CO6	PO3	L4	Design digital system components							
CO6	PO5	L4	Specific tool available for simulation and impleme	ntation						
CO6	PO9	L4	Applies to individual and team work for project, ir miniproject	iternship and						
C07	PO1	L4	Applies basic mathematics and science knowledge engineering problems	e for solution to						
C07	PO2	L4	Identify, formulate and review complex engineerir	ig problems						
C07	PO3	L4	Design digital system components							
C07	PO5	L4	Specific tool available for simulation and impleme	ntation						
C07	PO9	L4	Applies to individual and team work for project, ir miniproject	iternship and						
CO8	PO1	L4	Applies basic mathematics and science knowledge engineering problems	e for solution to						
CO8	PO2	L4	Identify, formulate and review complex engineerir	ig problems						
CO8	PO3	L4	Design digital system components							
CO8	PO5	L4	Specific tool available for simulation and impleme	ntation						
CO8	PO9	L4	Applies to individual and team work for project, ir 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

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1						
2						
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7						
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10						
11						
12						
13						
14						
15						

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Unit	Title	Teachi		No. of question in Exam						CO	Levels
		ng	CIA-	CIA-	CIA-	Asg-	Asg-	Asg-	SEE]	
		Hours	1	2	3	1	2	3			
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	C07	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.

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2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	СО	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,	L1, L2, L3
		CO9	
Assignment – 3	05	CO8, CO9	L1, L2, L3
Seminar – 1	05	C01, C02, C03, C04	L2, L3, L4
Seminar – 2	05	C05, C06,C07,C08,	L2, L3, L4
		CO9	
Seminar – 3	05	CO8, CO9	L2, L3, L4
Other Activities – define		CO1 to Co9	L2, L3, L4
– Slip test			, -,
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	Date	
				Planned	Conducte	

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1	Title	Verification of sampling theorem						
2	Course Outcomes	Reconstruction of the signal						
3	Aim	Verification of sampling theorem.						
4	Material /	Lab Manual						
	Equipment Required							
5	Theory, Formula,	Nyquist rate						
	Principle, Concept							
6	Procedure, Activity,	• step 1: start						
	Algorithm, Pseudo	step 2: write programming						
	Code	 step 3: save the program 						
		step 4: compile						
		 step 5:if error then correct the errors 						
		• step 6:run						
		• 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 Signa Frequency = ');						
		fs2 = input('Enter Sampling Frequency = Modulating Signa Frequency = ');						
		fs3 = input('Enter Sampling Frequency > Modulating Signa						
		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);						

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Copyri	ght ©2017. <i>ci</i>	AAS. All rights rese		<pre>xlabel('Time>'); ylabel('Amplitude title('Reconstructed Un %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 Nyqui subplot(4,2,5); plot(n,x2); xlabel('Time>');</pre>	>'); ndersampled fs<<2fm >'); ist Rate fs=2fm Signal	Signal');
				<pre>ylabel('Amplitude title('Reconstructed Ny %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> subplot(4,2,7); plot(n,x3); xlabel('Time>'); ylabel('Amplitude title('Reconstructed Oversampled Oversampled Oversampled fs></pre>	/quist Rate fs=2fm Sig n >'); >2fm Signal'); >');	
	Block, Model Reactior Expected	•	n, •			
	Observa Look-up Output					
		Calculation	s •	-		
		Outputs	1 0.5 soulduy -0.5	Sinusoidal Signal	10 0.8 50.5 52 54 0.4 0.2	
Prep	t EC bared by roved	/	-1-4	-2 0 2 4 Time Period	0 I Time Perior	Checked by

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11	Results & Analysis	• - • -	
12	Application Areas	Analog to Digital Converter	
13	Remarks		
	Faculty Signature with Date		

Experiment 02 /;Linear and Circular convolution

-	Experiment No.:	1	Marks		Date Planned	Date Conducte d			
1	Title	Linea	lear and circular convolution						
2	Course Outcomes	Conv							
3	Aim		ear and circular convolution of two given sequences, Commutat tributive and associative property of convolution.						
4	Material / Equipment Required	Lab N	Manual						
5	Theory, Formula, Principle, Concept		iply and add						
6	Activity, Algorithm, Pseudo Code	Step Step sequ	3: Assign ence	the lower a	• •	ience and impulse seq 5 for both input and 9n 'cony'			
		Step			-	t. Save and run the pro	ogram		
		h=in u1=i u2=i l2=ir a=l1 subp stem xlabe	put('enter tl nput('enter nput('enter t nput('enter t nput('enter t	ne sequence ne sequence the upper lin he lower lim the upper lin he lower lim	for h(n):') nit for x(n):') it for x(n):') nit for h(n):')				

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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 = (11+12):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	100								
4	2								
10 m 29	- 65								
9 1 45 0 65 1	15 2 0 02 04 05 08 1 12 14 15 18 2								
41 -05 0 05 1 Smith	1.0 .C								
12	ŕ .								
3- V 3-									
digen - o									
71 -0.5 0 0.5 1 1.5 2 3 0me	5 3 35 4								
11 Results & Analysis									
12 Application Areas Probability and statistic	5								
13 Remarks									
14 Faculty Signature									
with Date									

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Experiment 03 /; Auto correlation and cross correlation

_	Experiment No.:	1	Marks		Date Planned		Date Conducte d		
1	Title	Auto	correlation	and cross co	orrelation				
2	Course Outcomes	Simil	arity Analysi	s of two disc	crete seque	ences			
3	Aim		and cross erties	correlation	of two s	equences ar	nd verificatio	on of	their
4	Material / Equipment Required	Lab N	Manual						
5	Theory, Formula, Principle, Concept	Com	pare the seq	uences					
6	Activity, Algorithm, Pseudo Code	Step Step Step Step			-				
	Program	x= ir subp stem xlabe ylabe title(y=xc subp xlabe title(x=in slabe ylabe title(h=in subp stem xlabe	nput ('Enter a lot(3,2,1); (x); el('Time peri el('Amplitude 'Input seque corr(x); lot(3,2,2); el('Time peri el('Amplitude 'Auto correla put('Enter an lot(3,2,1); (x); el('Time peri el('Amplitude 'Input seque put('Enter an lot(3,2,2);	e'); ence'); od'); e'); ation'); ny sequence od'); e'); ence'); ny sequence od');	');				

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			title('Impulse sequence');	
			y = x corr(x,h);	
			subplot(3,2,3);	
			stem(y);	
			xlabel('Time period');	
			ylabel('Amplitude');	
			title('Cross correlation');	
	Block,	Circuit,		
	Model	Diagram,		
		n Equation,		
	-	d Graph		
	Observa			
	Table,	Look-up		
	Table, C	Dutput		
	Sample			
	Calculat			
10	Graphs,	Outputs	input response autocorrelation	
			3. φ	
			time time	
11	Results	& Analysis		
			Signal detection and pattern recognition	
	 Remark			
14	Facultv	Signature		
	with Da	-		

Experiment 04 /;Difference equation

-	Experiment No.:	1	Marks	Date Planned	Date Conducte d
1	1 Title		rence equat	ion	
2	2 Course Outcomes Sys		m design		
3	B Aim		ng a given d	ifference equation	
4	Material / Equipment Required	Lab N	Manual		
5	Theory, Formula, Principle, Concept	Calculating impulse response of the system			

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	^{ght ©2017.} Procedi	cAAS. All rights res	erved. Step 1: start	
	Activity		Step 2: read input sequence	
	-		Step 3: calculate impulse response	
	Code		Step 4: find out system coefficients	
			Step 5: print the result	
			step 6: stop	
	Prograr	n	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,	y(1) + y(11 + 1) + y(11 + 2) - x(11)	
	Model	Diagram,		
		n Equation,		
		ed Graph		
8	Observa	ation		
	Table,	Look-up		
	Table, (Output		
	Sample			
	Calcula		pole-zero plot filtered	signal
10	Graphs	, Outputs		
			0.5	-
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			0.5	\mathcal{M}
			-1. *	mm
				60 80 100

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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 Conducte d		
1	Title	Discr	viscrete Fourier transform					
2	Course Outcomes	Frequ	uency synth	esis				
3	Aim		omputation of N point DFT of a given sequence and to plot magnitude and nase spectrum					
4	Material / Equipment Required	Lab N	ab Manual					
5	Theory, Formula, Principle, Concept		Ilating impu	Ise respons	e of the system			
6	Procedure,	Step	1: start					
	Activity,	Step	2: read inpu	ut sequence				
	Algorithm, Pseudo	Step	3: calculate	impulse res	ponse			
	Code	Step	4: find out	system coef	ficients			
		Step	5: print the	result				
		step	6: stop					
	Program	PROC	GRAM: (Spec	trum Analys	is Using DFT)			
		N=in	put('type le	ngth of DFT	= ');			
		T=in	put('type sa	mpling peri	od= ');			
		freq=	=input('type	the sinusoi	dal freq= ');			
		k=0:I	N-1;					
		f=sin	(2*pi*freq*	1/T*k);				
		F=fft	(f);					
		stem	(k,abs(F));					
		grid o	on;					
		xlabe	el('k');					
		ylabe	l('X(k)');					
		INPU	T:					
		type	length of D	FT=32				
		type	sampling p	eriod=64				
		type	the sinusoid	dal freq=11				

	STITUTE OF AN	SKIT	Teaching Process Rev No.: 1.0
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8	ANGALORE	Title:	Course Lab Manual Page: 19 / 36
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	Block,	Circuit,	
	Model	Diagram,	
		n Equation,	
	Expecte	ed Graph	
8	Observa	ation	
	Table,	Look-up	
	Table, (Dutput	
	Sample		
	Calcula	tions	
	Graphs	, Outputs	$\begin{array}{c} 10 \\ 0.5 \\ - \\ - \\ 0.5 \\ - \\ - \\ 0.5 \\ - \\ - \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 7$
		& Analysis	
			Quantum mechanics and electrodynamics
13	Remark	S	
	Faculty with Da	Signature te	

Experiment 06 /; Verification of DFT Properties

-	Experiment No.:	1	Marks	Date	Date
				Planned	Conducted
1	Title	Verif	ication of D	FT properties	
2	Course Outcomes	Frequ	uency synth	esis	
3	Aim	Verif	ication of D	FT properties	
4	Material /	Lab M	Manual		
	Equipment				
	Required				
5	Theory, Formula,	Linea	rity and Par	seval's theorem	
	Principle, Concept				
6	Procedure,	Step	1: start		
	Activity,	Step	2: read inpu	it sequence	

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	-	Step 3: calculate impulse response	
Code		Step 4: find out system coefficients	
		Step 5: print the result	
		step 6: stop	
Progra		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;	
	1	f=sin(2*pi*freq*1/T*k);	
	1	F=fft(f);	
	9	stem(k,abs(F));	
	9	grid on;	
	2	xlabel('k');	
	Ŋ	ylabel('X(k)');	
	1	INPUT:	
	1	type length of DFT=32	
	1	type sampling period=64	
	1	type the sinusoidal freq=11	
		OUTPUT: (Spectrum Analysis Using DFT)	
7 Block,	Circuit,		
Model	Diagram,		
	on Equation,		
_	ed Graph		
8 Observ			
Table,	-		
	Output		
9 Sample			
Calcula			
10 Graphs		Enter the x sequence $==>[2 4 6 8]$	
		Enter the h sequence $==>[1035257]$	
		5	1 -15.4082i -6.9436
		+ 0.9369i 5.0000 + 1.7321i Columns 5 through 8	
		-1.1625 + 4.4396i 5.0000 - 1.7321i -6.9436 - 2.1061 +15.4082i	U.93091 Column 9
		2.1001 +13.40021	
	s & Analysis	Quantum machanics and electrodynamics	
		Quantum mechanics and electrodynamics	
13 Remar			
-	/ Signature		
with D	ale		



Experiment 07 /; Design and Implementation of FIR filter

-	Experiment No.:	1	Marks		Date		Date		
					Planned		Conducted		
1	Title	-	-	ementation					
2	Course Outcomes	Desig	Design and Implementation of FIR filter						
3	Aim	Desig	Design and Implementation of FIR filter						
4	Material /	Lab M	Ianual						
	Equipment								
	Required								
5	Theory, Formula,	Wind	ow Techniq	ue					
	Principle, Concept								
6	Procedure,	Step	1: Assign	the variable	for pass b	and ripple	,stop band r	ipple, pass	
	Activity,		and stop						
	Algorithm, Pseudo	Step	2 :band fr	equency De	termine the	order of	filter using th	ne required	
	Code	form							
				filter co-effi					
		1 -	-		amplitude F	lot the ma	gnitude and p	ohase angle	
			PF.HPF,BPF&						
		-		x label and	y label and	title it			
	Program		nming wind						
		rp=input('enter the PB ripple');							
		rs=input('enter the SB ripple');							
		1 -	-	PB frequency					
			-	B frequency					
		-		Impling freq	uency');				
			2*(fp/f);						
			2*(fs/f);						
			-	(sqrt(rp*rs))	-13;				
			14.6*(fs-fp						
			il(num/den));					
		n1 = n							
			n(n,2)~=0);						
		n1=n	,						
		n=n- end;	1,						
		´	mming(n1)						
		y=na %LPF	mming(n1);						
			1(n,wp,y);						
			=freqz(b,1,2	256).					
			=rreq2(b, r, z)*log10(abs						
			lot(2,2,1);	D(1177),					
		Sunh	οι(Ζ,Ζ,Τ),						

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			plot(o/pi,M);	
			ylabel('gain indB');	
			xlabel('(a) normal frequency');	
			%HPF	
			b=fir1(n,wp,'high',y);	
			[h,o] = freqz(b,1,256);	
			$m=20*\log 10(abs(h));$	
			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);	
			$m=20*\log 10(abs(h));$	
			subplot(2,2,4);	
			plot(o/pi,m);	
			ylabel('gain in dB')	
			ylabel(gall in ab)	
			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,		
	Reactio	n Equation,		
		ed Graph		
8	Observa	ation		
	Table,	Look-up		
	Table, (Output		
9	Sample			
	Calcula	tions		
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11	Results	& Analysis		
12	Applica	tion Areas	Quantum mechanics and electrodynamics	
13	Remark	S		
14	Faculty	Signature		
	with Da	te		

Experiment 08 /; Design and Implementation of IIR filter

-	Experiment No.:	1	Marks		Date	Date			
					Planned	Conducted			
1	Title	Desig	n and Impl	ementation o	of IIR filter				
2	Course Outcomes	Desig	esign and Implementation of IIR filter						
3	Aim	Desig	esign and Implementation of IIR filter						
4	Material /	Lab M	anual						
	Equipment								
	Required								
5	Theory, Formula,	For Gi	ven specifi	cations					
	Principle, Concept								
6	Procedure,	Step1:	: Start the r	nat lab softw	vare				
	Activity,	Step2	: Assign th	e variable fo	r pass band rip	ple ,stop band ripple, pass b	and		
	Algorithm, Pseudo	and st	op band fr	equency					
	Code	Step3	: Determin	e the order	of filter using tl	ne required formula.			
		Step4	: Find the	filter co-effi	cient a and b				
			•	e time and a	•				
				-	nd phase angle				
				-	label and title	it			
		-		run the prog	ram				
	Program	%LPF%							
				he pass ban	• •				
				he stop ban					
			•	•	nd frequency');				
			•	•	d frequency');				
		-		he sampling	frequency');				
		w1=2	*(wp/fs);						

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			w2=2*(ws/f			
				o1ord(w1,w2,rp,rs);		
			[b,a]=cheby	-		
			w=0:0.01/p	•		
			[h,om]=frec			
			m=20*log1			
			an=angle(h)			
			subplot(2,2			
			plot((om/pi)			
			xlabel('time			
			ylabel('ampl			
				ude plot of lpf');		
			subplot(2,2			
			plot((om/pi)			
			xlabel('time			
			ylabel('ampl			
			title('angle p	plot of lpf');		
	Block,	Circuit,				
	Model	Diagram,				
		n Equation,				
	-	d Graph				
	Observa –					
	Table,	Look-up				
	Table, C	Jutput				
	Sample					
	Calculat			magnituda plat of lef		angle plot of lpf
10	Graphs,	Outputs	²⁰⁰ Г	magnitude plot of lpf	4	angle plot of lpf
					2	
			0 blitter		amplitude	
			la -200 /		ampi	\searrow \land \land \land \land
			[[-2	
			-400 L 0	0.5	4 1 0	
				time		time
11	Poculto	8 Apolycia				
		& Analysis	Ouantum m	ochanics and electrody	vnamice	
			Quantum m	echanics and electrod	ynamics	
	Remark					
		Signature				
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Experiment 08 /; Linear Convolution using DSP Kit

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*8	Title:	Соι	urse Lab Mai	nual			Page: 25 / 36	
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_	Experiment No.:		Marks	-	Date lanned		Date Conducted	
1	Title	Verif	y linear conv	volution using S	Simulator	and DSP Kit	:	
-	Course Outcomes		-					
	Aim			near convolutio	n using Si	mulator and	d DSP Kit	
		Lab N	Manual					
	Equipment Beguired							
	Required	For C	ivon cnocifi	cations				
	Theory, Formula, Principle, Concept		iven specifi	Cations				
6	Procedure,	Step	I: Start the e	editor				
	-	-	2:type the p	-				
	Algorithm, Pseudo			-				
	Code	-		run the progra				
				nto machine lev		c		
	D	-		DSP Kit and ob	serve wav	eforms		
	Program		ude <stdio.h< th=""><th>1></th><th></th><th></th><th></th><th></th></stdio.h<>	1>				
		r	main()					
		r	int m=4;					
			int $n=4$;					
			int i,j;					
			•	={1,2,3,4,0,0,0,	,0};			
				={1,2,3,4,0,0,0				
			int y[10];					
			for(i=0;i<	<(m+n+-1);i++	-)			
			{					
				[i]=0;	`			
			TO	r(j=0;j<=i;j++)			
			ĩ	y[i]+=x[j]	*h[i_i]·			
			}	λ[ı]+−×Ü]	ıı <u>[</u> ı– <u>J</u>],			
			}					
			-	near Convolutio	on Output	==>\n\n")	;	
				<(m+n-1);i++)	· · · · · · ·	(- ()		
			{					
			pr	rintf(" ==> %d\	n",y[i]);			
			}					
		}						
	Block, Circuit,							
	Model Diagram,							

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	Reactio	n Equation,		
	Expecte	ed Graph		
8	Observa	ation		
	Table,	Look-up		
	Table, (Output		
9	Sample			
	Calcula	tions		
10	Graphs	, Outputs	Y =2 12 34 73 100 96 63	
11	Results	& Analysis		
12	Applica	tion Areas	Quantum mechanics and electrodynamics	
13	Remark	S		
14	Faculty	Signature		
	with Da	ite		

Experiment 10 /; Circular Convolution using DSP Kit

-	Experiment No.:	1	Marks		Date	Date			
					Planned	Conducted			
1	Title	Verify	y Circular C	onvolution us	ing DSP Kit				
2	Course Outcomes	LTI R	Response						
3	Aim	Verify	y Circular C	onvolution us	ing DSP Kit				
4	Material /	Lab N	/Ianual						
	Equipment								
	Required								
5	Theory, Formula,	For G	iiven specifi	cations					
	Principle, Concept								
6	Procedure,	Step1	: Start the	editor					
	Activity,	Step	2: Type the	program					
	Algorithm, Pseudo	Step	3: Save pro	gram in .c ext	ension				
	Code	Step ·	4: Save and	run the prog	am				
		Step	5: convert i	nto machine l	evel code				
		Step	6 : Connect	DSP Kit and c	bserve wavefo	rms			
	Program	#incl	ude <stdio.< td=""><th>1></th><th></th><td></td></stdio.<>	1>					
		void	main()						
		{							
				y[20],h[20];					
				t[20][20];					
			int circnv						
			int i,j,k,n	n,n;					

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Copyright ©2017. c/		rved.	
Copyright @2017. cr	Title:	<pre>SKIT.Ph5b1.F03 Course Lab Manual rved. 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)</n;i++) </n;i++) </pre>	Date:11-07-2019 Page: 27 / 36
7 Plock	Circuit	<pre>{ h[j]=y[i]; j++; } for(i=0;i<1;i++) for(j=0;j<n;j++) cirmat[i][0]="h[k];" cirmat[i][j+1]="cirmat[i-1][j];" cirmat[i][j]="h[j];" for(i="1;i<n;i++)" for(j="0;j<n;j++)" k="k-1;" pre="" {="" }="" }<=""></n;j++)></pre>	
7 Block,	Circuit,		
Model	Diagram,		

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	Reactio	n Equation,		
	Expecte	ed Graph		
8	Observa	ation		
	Table,	Look-up		
	Table, O	Dutput		
9	Sample			
	Calcula	tions		
10	Graphs,	, Outputs	Enter X Sequence $==>[2 4 6 8]$	
			Enter Y Sequence $==>[12 \ 14 \ 5 \ 7 \ 8]$	
			Circular Convoluted Sequence $= > 138 180 202 214$	186
11	Results	& Analysis		
12	Applica	tion Areas	Quantum mechanics and electrodynamics	
13	Remark	S		
14	Faculty	Signature		
	with Da	te		

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

_	Experiment No.:	1	Marks	Date Planned	Date Conducted				
1	Title	N-pc	oint DFT of a	given sequence					
2	Course Outcomes	Frequ	uency Synth	esis					
3	Aim	Verif	y N-point D	FT of a given sequence using	DSP Kit				
4 Material / Lab Manual									
	Equipment								
	Required								
5	Theory, Formula,	For C	liven specifi	cations					
	Principle, Concept								
6	Procedure,	Step	I: Start the	editor					
	Activity,	Step	2: Type the	program					
	Algorithm, Pseudo	Step	3: Save pro	gram in .c extension					
	Code	Step	4: Save and	run the program					
		Step	5: convert i	nto machine level code					
		Step	Step 6 : Connect DSP Kit and observe wave forms						
	Program	#incl	ude <stdio.ł< td=""><th>></th><td></td></stdio.ł<>	>					
		#incl	ude <math.l< td=""><th> ></th><td></td></math.l<>	>					
		void	main()						
		{							
			float xi[3	2],xr[32],yi[64],yr[64];					
			float Wn,	PHI,cs,sn;					

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		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++)< td=""><td></td></n;i++)<>	
		{	
		printf("\n==> x[%d] <==",i);	
		scanf("%f",&xr[i]);	
		}	
		for(i=0.0;i <n;i++)< td=""><td></td></n;i++)<>	
		{	
		xi[i]=0.0;	
		$\begin{cases} f_{0} = (1 - 0) \cdot i = (2 + n) \cdot i + 1 \\ f_{0} = (1 - 0) \cdot i = (1 - n) \cdot $	
		for(i=0.0;i<(2*n);i++)	
		۲ yi[i]=0.0;	
		yr[i]=0.0; yr[i]=0.0;	
		}	
		Wn=(float)6.2831853/n;	
		for(i=0;i <n;i++)< td=""><td></td></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++)< td=""><td></td></n;j++)<>	
		{ vi1=0.0;	
		VII – 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;	

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			yi[i]=cs * vi1 - vi2 + sn * vr1;	
			}	
			for(i=0;i< n;i++)	
				C III · C·1 · C·1
			printf(" $n = R \approx 1 \text{ g/} = R \approx 1 \text{ g/}$; ",I,yr[I],yI[I]);
			}	
7	Dia ali	Cincuit	}	
	Block, Model	Circuit,		
		Diagram, n Equation,		
		ed Graph		
	Observa	-		
	Table,	Look-up		
	Table, (-		
	Sample	Julpul		
	Calcula	tions		
			Enter the x sequence $==>[4 \ 6 \ 8 \ 9]$	
	Chapito	-	y = 27.0000 - 4.0000 + 3.0000i - 3.0000 - 4.0000 - 3.00000 - 3.0000000000	0000i
			,	
			mag=27 5 3	
			pha = 0.4981 3.1416 -2.4981	
11	Results	& Analysis		
12	Applica	tion Areas	Quantum mechanics and electrodynamics	
13	Remark	S		
	-	Signature		
	with Da	te		

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

-	Experiment No.:	1	Marks	Date	Date
				Planned	Conducted
1	Title	N-pc	oint DFT of a	given sequence	
2	Course Outcomes	Frequ	uency Synth	esis	
3	Aim	Verif	y N-point D	FT of a given sequence u	sing DSP Kit
4	Material /	Lab M	Manual		
	Equipment				
	Required				
5	Theory, Formula,	For C	Given specifi	cations	
	Principle, Concept				
6	Procedure,	Step	I : Start the e	ditor	

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Activity		Step 2: Type the program	
		Step 3: Save program in .c extension	
Code		Step 4: Save and run the program	
		Step 5: convert into machine level code	
		Step 6 : Connect DSP Kit and observe wave forms	
Program		#include <stdio.h></stdio.h>	
		#include <math.h></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++)< td=""><td></td></n;i++)<>	
		{	
		printf(" $n = x [\%d] < = ",i$);	
		scanf("%f",&xr[i]);	
		}	
		for(i=0.0;i <n;i++)< td=""><td></td></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++)< td=""><td></td></n;j++)<>	

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			{		
			vil	=0.0;	
				tmp=vrl;	
				vr1 = (2*cs*vr1) - (vr2 + xr[j]);	
				vr2=tmp;	
				tmp=vi1; vi1=(2*cs*vi1) - (vi2+xi[j]);	
				vi2=tmp;	
			3	viz – tinp,	
			vr[i]=cs * vr]	– vr2 – sn * vi1;	
			•	-vi2 + sn * vr1;	
			}	,	
			for(i=0;i <n;i++)< td=""><td></td><td></td></n;i++)<>		
			{		
				$("\n==> R % f J % f$	",i,yr[i],yi[i]);
			}		
			}		
7	Block,	Circuit,			
	Model	Diagram,			
		n Equation,			
		d Graph			
	Observa				
	Table,	Look-up			
	Table, C	Dutput			
	Sample				
	Calculat Crowbe		Farran 4 b		
10	Graphs,	-	Enter the x sequence		
			y = 27.0000 - 4.0000	0 + 3.0000i -3.0000 -4.0000 - 3.0	0001
			mag=27 5 3		
			mag=27 5 5		
			pha = 0.4981 3.141	6 -2.4981	
			•		
11	Results	& Analysis			
12	Applica	tion Areas	Quantum mechanics	and electrodynamics	
13	Remark	s			
14	Faculty	Signature			
	with Da	te			



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

-	Experiment No.:	1	Marks	Date Planned		Date Conducted		
1	Title	Impu	lse response	e of first order and sec				
2	Course Outcomes	Syste	m Analysis					
3	Aim	Impu	lse response	e of first order and sec	ond order sy	stem using DSP Kit		
4	Material / Equipment Required	Lab N	Manual					
5	Theory, Formula, Principle, Concept		iven specifi	cations				
6	Procedure,	Step	I : Start the e	editor				
	Activity,	Step	2: Type the	program				
	Algorithm, Pseudo	Step	3: Save prog	gram in .c extension				
	Code	Step	tep 4: Save and run the program					
		Step	tep 5: convert into machine level code					
		Step	6 : Connect	DSP Kit and observe w	ave forms			
	Program	#incl	ude <stdio.h< td=""><td>></td><td></td><td></td><td></td></stdio.h<>	>				
		#incl	ude <math.h< td=""><td>1></td><td></td><td></td><td></td></math.h<>	1>				
		void	main()					
		{						
			float h[10)];				
			int m,n;					
			printf("En	ter the value of N");				
			scanf("%d	",&m);				
			for(n=0;r	i <m;n++)< td=""><td></td><td></td><td></td></m;n++)<>				
			{	• // /- /- /- /- /- /- /- /- /				
			h[}	n]=((2.0/3.0)*(pow(0.5	5,n))+(1.0/3.	0)*(pow(0.25,n)));		
			printf(" In	npulse Response Outp	ut ==> $n"$;			
				l <m;n++)< td=""><td></td><td></td><td></td></m;n++)<>				
			{ pr	$\inf((\wedge n = > \%f',h[n]))$				
			}					
		}	-					
7	Block, Circuit,							

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	Model	Diagram,		
	Reactio	n Equation,		
	Expecte	ed Graph		
8	Observ	ation		
	Table,	Look-up		
	Table, (Dutput		
9	Sample			
	Calcula	tions		
10	Graphs	, Outputs	The impulse response is:	
			Columns 1 through 8 1.0000 0.4167 0.1875 0.0	885 0.0430 0.0212 0.0105
			0.0052Columns 9 through 12 0.0026 0.0013 0.0	0007 0.000
11	Results	& Analysis		
12	Applica	tion Areas	Quantum mechanics and electrodynamics	
13	Remark	S		
14	Faculty	Signature		
	, with Da	-		

Experiment 13 /; Implementation of FIR filter using DSP Kit

-	Experiment No.:	1	Marks		Date Planned	Date Conducted		
1	Title	Imple	ementation	່ of FIR filter ເ	ising DSP Kit	Jonaueteu		
2	Course Outcomes	FIR F	ilter design					
3	Aim	Imple	ementation	of FIR filter ι	ising DSP Kit			
4	Material /	Lab N	Manual					
	Equipment							
	Required							
5	Theory, Formula,	For C	iven specifi	cations				
	Principle, Concept							
6	Procedure,	Step1	: Start the e	editor				
	Activity,	ity, Step 2: Type the program						
	Algorithm, Pseudo	Step	Step 3: Save program in .c extension					
	Code	Step	4: Save and	run the prog	gram			
		Step	5: convert i	nto machine	level code			
		Step	6 : Connect	DSP Kit and	observe wave fo	rms		
	Program	#incl	ude <stdio.ł< th=""><th>1></th><td></td><td></td></stdio.ł<>	1>				
		#incl	ude <math.ł< th=""><th>1></th><td></td><td></td></math.ł<>	1>				
		void	main()					
		{						
			float sg[2	200],i;				
			long floa	t y[200];				

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Noroco the second	Doc Code:	SKIT.Ph5b1.F03	Date:11-07-2019
ANGALOR	Title:	Course Lab Manual	Page: 35 / 36
Zopyright ©2017.	CAAS. All rights rese	int j; float h[31]={0.0043,0.0050,0.0067,(0.0237,0.0297,0.0358,0.0 0.0571,0.0603,0.0623,0.0 0.0571,0.0528,0.0477,0.0 0.0237,0.0183,0.0135,0.0 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)+(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) {	0419,0.0477,0.0528, 0629,0.0623,0.0603, 0419,0.0358,0.0297, 0096,0.0067,0.0050, (0.5*sin(2.0*3.14*100.0*i))); m+h[k]*sg[n-k];
	Diagram, on Equation, ed Graph		

Prepared by Approved

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