Ref No:

Sri Krishna Institute of Technology,
Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	UG
Semester :	IV
Course Code:	18EC45
Course Title:	Signals & Systems
Credit / L-T-P:	4/4-0-0
Total Contact Hours:	40
Course Plan Author:	M.Nagaraja

Academic Evaluation and Monitoring Cell

Sri Krishna Institute of Technology
#29,Chimney hills,Hesaraghata Main road, Chikkabanavara Post
Bangalore – 560090, Karnataka, INDIA

Phone / Fax :08023721477/28392221/23721315
Web: www.skit.org.in , e-mail: skitprinci@gmail.com

Table of Contents

A. COURSE INFORMATION

1. Course Overview

Degree:	B.E	Program:	UG
Semester:	IV	Academic Year:	2019-20
Course Title:	Signals & Systems	Course Code:	18EC45
Credit / L-T-P:	4/4-0-0	SEE Duration:	180 minutes
Total Contact Hours:	40	SEE Marks:	60
CIA Marks:	30	Assignment	10
Course Plan Author:	M.Nagaraja	Sign ..	
Checked By:		Sign ..	
CO Targets	CIA Target :20	SEE Target:	45

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

Module	Content	Teaching Hours	Blooms Learning Levels
1	**Introduction and Classification of signals**: Definition of signal and systems, communication and control system as examples Classification of signals. **Basic Operations on signal**s: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal. **Elementary signals/Functions**: Exponential, sinusoidal, step,impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals.	8	L1,L2,L3
2	**System Classification and properties**: Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, stable-unstable, invertible. **Time domain representation of LTI System**: Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.	8	L1,L2,L3
3	**LTI system Properties in terms of impulse response**: System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution, and step response. **Fourier Representation of Periodic Signals**: CTF Sproperties and basic problems.	8	L1,L2,L3
4	**Fourier Representation of aperiodic Signals**: Introduction to Fourier Transform & DTFT, Definition and basic problems. **Properties of Fourier Transform**: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform.	8	L1,L2,L3
5	**The Z-Transforms**: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems.	8	L1,L2,L3

-	**Total**		

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
	Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.		In Lib
			In Lib
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1	Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.		In Lib
2	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.		In Lib
3	H.P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006.		In Lib
4	B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005.		In Lib
5	Ganesh Rao and SatishTunga, "Signals and Systems", Pearson/Sanguine.		In Lib
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
1	https://www.youtube.com/watch?v=PHtoMPqs_Gc		
2	https://www.youtube.com/watch?v=G2axsmS12Ms		
3	https://www.youtube.com/watch?v=iDMwtJxXb28&vl=en		
4	https://www.youtube.com/watch?v=QLCXSxgxRPY		
5	https://www.youtube.com/watch?v=wG6VUnkrO90		
D	**Software Tools for Design**	**-**	**-**
	MATLAB		
E	**Recent Developments for Research**	**-**	**-**
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1	NPTEL VIDEOS		In Lib

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	18EC31	Engg Maths	Fourier Transform	3		L2

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	18EC45.1	Understand the basic elementary signals and their classification by mathematical description.	8	Lecture	Slip Test	L2 Understand
2	18EC45.2	Develop input output relationship for LTI system and understand the convolution operation for continuous time and Discrete signals.	8	Lecture	Assignment	L3
3	18EC45.3	Resolve the signals in frequency domain using Fourier transform of continuous time signal	8	Lecture	Assignment and Slip Test	L2 Understand
4	18EC45.4	Apply Fourier transform representation to study and resolve the signal and system	8	Lecture and Tutorial	Assignment	L3 Apply
5	18EC45.5	Apply z-transform and its properties for the analysis of discrete time system using partial fraction expansion method.	8	Lecture	Slip test	L3 Apply
-	-	**Total**	**40**	-	-	-

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Speech and audio processing, biological signal analysis	CO1	L2
1	Remote sensing system.	CO1	L2
2	Radars, Digital filter design.	CO2	L3
2	Distance phone calls, Digital recording, image processing.	CO2	L3
3	Radars, Digital filter design	CO3	L2
3	3Distance phone calls, Digital recording, image processing	CO3	L2
4	Amplitude modulation, frequency multiplexing	CO4	L3
4	Circuit analysis, sampling	CO4	L3

5	Analysis of digital system,system design,automatic controls in telecommunication.	CO5	L3
5	Simulate the continuous system, Analysis of digital filters	CO5	L3

3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	18EC45.1	Understand the basic elementary signals and their classification by mathematical description.	3	3							2			1				
2	18EC45.2	Develop input output relationship for LTI system and understand the convolution operation for continuous time and Discrete signals.	3	3							2			1				
3	18EC45.3	Resolve the signals in frequency domain using Fourier transform of continuous time signal	3	3							2			1				
4	18EC45.4	Apply discrete time Fourier transform representation to study and resolve the signal and system	3	3							2			1				
5	18EC45.5	Apply z-transform and its properties for the analysis of discrete time system using partial fraction expansion method.	3	3							2			1				
-	**17EC62.**	Average	**3**	**3**							**2**			**1**				**-**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	MATLAB	Seminar	3rd week of March 2020		List from B4 above
2	MATLAB to Obtain the spectrum of signals	Seminar	3rd Week April 2020		List from B4 above

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Mod	Title	Teach.	No. of question in Exam	CO	Levels

ules		Hours	CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction and Classification of signals ,Basic Operations on signals ,Elementary signals / Functions	8	2	-	-	1	1	2	CO1, CO2	L1, L2
2	System Classification and properties: Time domain representation of LTI System	8	2	-	-	1	1	2	CO3, CO4	L2, L3
3	LTI system Properties in terms of impulse response Fourier Representation of Periodic Signals	8	-	2	-	1	1	2	CO5, CO6	L2, L3
4	Fourier Representation of aperiodic Signals Properties of Fourier Transform: .	8	-	2	-	1	1	2	CO7, C08	L2, L3
5	The Z-Transforms	8	-	-	4	1	1	2	CO9, CO10	L2, L3
-	**Total**	**40**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1,CO2	L1,L2, L3
3, 4	CIA Exam – 2	30	CO3,CO4	L2, L3
5	CIA Exam – 3	30	CO5	L2, L3
1, 2	Assignment - 1	10	CO1,CO2	L1,L2, L3
3, 4	Assignment - 2	10	CO3,CO4	L2, L3
5	Assignment - 3	10	CO5	L2, L3
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities – Mini Project	-		
	Final CIA Marks		**-**	**-**

D1. TEACHING PLAN - 1

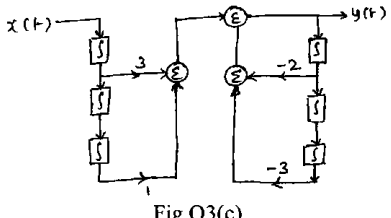
Module - 1

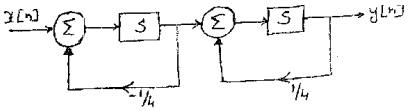
Title:		Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
	Understand the basic elementary signals and their classification by mathematical description.	CO1	**L2**
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Introduction: Definitions of signals and a system	CO1	L2

2	Classification of signals.	CO1	L2
3	Basic operations on signals: Amplitude and time operations	CO1	L2
4	Folding, Time shifting, time scaling operations	CO1	L2
5	Problems	CO1	L2
6	Problems	CO2	L2
7	Elementary signals and their representation	CO2	L2
8	Elementary signals viewed as interconnections of operations,	CO2	L2
9	properties of systems.	CO2	L2
10	problems	CO2	L2
c	**Application Areas**		
-	Students should be able employ / apply the Module learnings to . . .		
1	Speech and audio processing, biological signal analysis	CO1	L2
d	**Review Questions**		
-			
1	Define Signals and systems?	CO1	L2
2	What are the major classifications of the signal?	CO1	L2
3	Explain the basic elementary signals with their mathematical equation?	CO1	L2
4	Define periodic signal and non-periodic signal?	CO1	L2
5	Define Energy and power signal ?	CO1	L2
6	Define even and odd signal ?	CO1	L2
7	Determine whether the following systems are linear,time invariant,causal ,stable. y(n)=log(x(n)).	CO1	L2
8	Determine whether the following systems are linear or not dy(t) / dt + 3ty(t) = t2 x(t) & y(n)=2x(n)+ 1 / x(n-1)	CO1	L2
9	Determine whether the following systems are Time-Invarient or not Y(t) = t x(t) & y(n) = x(2n)	CO1	L2
10	Find whether the signal x(t) = 2 cos (10 t+1) – sin(4t-1) is periodic or not. (6) Evaluate Σ n=(-∞ to ∞) e 2n δ (n-2)	CO1	L2
11	b) Determine whether the following signals are energy or power and calculate their energy and power. i) x(n)=(1/2)n u(n) ii) x(t)= rect(t/To) iii) x(t)=cos2 (Ωt)	CO1	L2
12	Define unit step, ramp, pulse, impulse and exponential signals. Obtain the relationship between the unit step and unit ramp function.	CO1	L2
13	Find the fundamental period T of the signal , x(n)=cos(nπ/2)-sin(nπ/8)+3cos(nπ/4 + π/3)	CO1	L2
14	Determine the power of the following signals. i) $x_1(t)$=5cos(50t+π/3) ii) $x_2(t)$= 20cos50tcos15t	CO1	L2
15	Determine whether the following systems are time variant or time -invariant. i) y(t)=tx(t) ii)y(n)=x(2n)	CO1	L2
16	Determine whether the following signal is periodic. If periodic , determine the fundamental period: X(t)=3cost+4cos(t/2) X(t)=cos60πt+sin50πt	CO1	L2
17	Determine whether the following system is linear, time invariant, causal, stable and static 1. y(n) = x2 (n) 2. y(n) = x(-n)	CO1	L2
18	A discrete time signal is given by x(n)={1,1,1,1,2} Sketch the following signals a)x(n-2) b)x(n+1) c)x(3-n) d)x(n)u(n-1) e)x(n-1)δ(n-1) f)Even samples of x(n) g)odd samples of x(n)	CO1	L2

Module – 2

Title:		Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	Develop input output relationship for LTI system and understand the convolution operation for continuous time and Discrete signals.	CO2	**L3**

b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
11	ISystem Classification and properties	CO3	L3
12	Linear-nonlinear,	CO3	L3
13	Time variant-invariant	CO3	L3
14	causal-noncausal,	CO3	L3
15	static-dynamic,	CO4	L3
16	stable-unstable, invertible.	CO4	L3
17	ime domain representation of LTI System:	CO4	L3
18	Impulse response, convolution sum, convolution integral	CO4	L3
19	Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential		
20	exponential and exponential, unit step and rectangular, and rectangular and rectangular..		
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Radars, Digital filter design.	CO3	L3
2	Distance phone calls, Digital recording, image processing.	CO4	L3
d	**Review Questions**	-	
-			
1	The impulse response of a continuous time LTI system is given by $h(t)=e^{2t}u(t-1)$ check whether the system is stable causal and memoryless.	CO2	L3
2	A continuous time LTI system with unit impulse response $h(t)=u(t)$ and input $x(t)=e^{-at}$ $u(t)$ $a>0$ find the output $y(t)$ of the system.	CO2	L3
3	Find the step response for the LTI system represented by the impulse response $h(n)=(1/2)^n$ $u(n)$.	CO2	L3
4	consider a continuous time LTI system is represented by the impulse response $h(t)=e^{-3t}$ $u(t-1)$ determine whether it is i)stable ii) causal	CO2	L3
5	Solve the differential equation, $d^2y(t)/dt^2 + 3\ dy(t)/dt + 2y(t) = 2x(t)$ with $y(0)=-1$ $dy(t)/dt$ with $t=0$ and $x(t)=cost\ u(t)$	CO2	L3
6	The impulse response of a continuous time LTI system is given by $h(t)=e^{2t}u(t-1)$ check whether the system is stable,causal and memoryless.	CO2	L3
7	Find the response of the system described by difference equations $y(n)-1/9\ y(n-2)=x(n-1)$ with $y(-1)=1$, $y(-2)=0$ and $x(n)=u(n)$	CO2	L3
8	find the difference equation representation for the block diagram representation of continuous time LTI system shown in figure 3c,  Fig.Q3(c)	CO2	L3
9	Determine the conditions so that the continuous time system with impulse response $h(t)=e^{at}u(-t)$ is stable. Also find out whether the system is i)causal ii) memoryless	CO2	L3
10	Represent the differential equation given below in direct form I and II $d^2y(t)/dt^2 + 3\ dy(t)/dt + 2y(t) = d^2y(t)/dt^2 + dx(t)/dt^2$	CO2	L3
11	Find the zero input response and forced response for the system described by the difference equation $y(n)-1/4\ y(n-2)=2x(n)+x(n-1)$ given $x(n)=u(n)$; $y(-2)=8$,$y(-1)=0$.	CO2	L3
12	For the given impulse response determine whether system is memory less,	CO2	L3

	stable and causal justify your answer $h(n)=2^n u(-n)$		
13	Given impulse response of the system $h(n)=(1/2)^n u(n-2)$ find out step response of the system.	CO2	L3
14	Draw direct form-I and direct form- II implementation for the following difference equation $y(n)-1/4\ y(n-1)-1/8y(n-2)=2x(n)+3x(n-1)$	CO2	L3
15	Find the step response of a LTI system if impulse response $h(t)=t^2\ u(t)$	CO2	L3
16	Obtain the response of the system given by $d^2y(t)/dt^2\ y(t) + y(t) = 3\ dx(t)/dt$ with $y(0)=-1$, $dy(t)/dt = d^2y(t)/dt^2=1$ and $2e^{-t}\ u(t)$	CO2	L3
17	Find the difference equation for the system shown in fig.  Fig.Q.3(c)	CO2	L3

E1. CIA EXAM – 1

a. Model Question Paper - 1

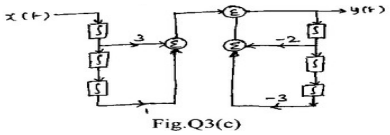
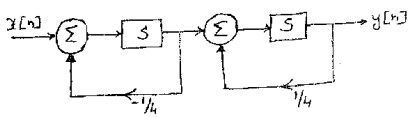
Crs Code:	18EC45	Sem:	IV	Marks:	30	Time:	90 minutes
Course:	Signals & Systems						

-	-	**Note: Answer all questions, each carry equal marks. Module : 1, 2**	**Marks**	**CO**	**Level**
1	a	Distinguish between: i) Energy signal and Power signal ii)Continuous and Discrete time signals iii) Even and Odd signal iv)Periodic and non periodic signals	8	CO1	L2
	b	Determine the even and Odd components of the signal i) $x(t)=1+t^2+t\ tant+tan^2t\ cot\ t + cot^3t$ ii) $x(t)=[sint+cost]^3$	7	CO1	L2
2	a	Determine whether the following signals are periodic, if periodic determine the fundamental period i) $x(t)=[2cos^2(\Pi t/2)-1]sin\Pi t\ cos\Pi t$ ii) $x(n)=cos(\Pi n/7)\ sin(\Pi n/3)$	8	CO1	L3
	b	Determine the following signal is Energy or Power signal i) $x(t)=e^{-a\|t\|}$ $a>0$ ii) $x(t) = 5+t$ for $(-5,-4)$; 1 for $(-4, 4)$; $5-t$ for $(4, 5)$; 0 otherwise	7	CO1	L2
3	a	Draw the signal i)$x(t)=3r(t-1)-4r(t-2)-6r(t-3)+r(t)$ ii)$Y(t)=[[x(t)+x(2-t)]u(1-t)]u(t)$	7	CO1	L2
	b	b) Express x(t) interms of g(t) using shifting and scaling of 3stepped staircase signal	8	CO1	L3
4	a	Determine whether the system is i) Linear ii) Time Invariant iii) memoryless iv) causal v) stable i) $y(t)=d/dt[e^{-t}\ x(t)]$ ii) $y(n)=x(k+2)$	8	CO2	L3
	b	Determine the relationship between the signals.	7	CO2	L3

b. Assignment -1

Crs Code:	17EC62	Sem:	VI	Marks:	30	Time:	90 minutes
Course:	ARM Microcontroller & Embedded System						

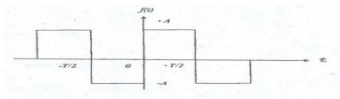
SNo	Assignment Description	Marks	CO	Level
1	Define signals and systems, with appropriate examples?	5	CO1	L3
2	Write a note on classification of signals with suitable examples?	5	CO1	L3
3	Find the even and odd components of the signal $x(t) = (1+t^3)\cos^3(10t)$.		CO1	L3
4	Find the overall operator of the system $y(n) = 1/3[x(n+1)+x(n)+x(n-1)]$.	5	CO1	L3
5	Determine whether the system $y(t) = x(t/2)$ is i) linear ii)Time invarient iii)memory iv)causal v)stable	5	CO1	L3
6	Sketch the following signal, hence find the even and odd component of signal, draw even and odd part of $x(t) = u(t) - r(t-1)+2r(t-2)-r(t-3)$	5	CO1	L3
7	State whether the following signals is periodic or not, if periodic find the fundamental period: i)$x(n) = \cos(\pi n/2)+\sin(\pi n/2)$ ii)$x(t)=\cos(2\pi t).\ \sin(2\pi t)$)	5	CO1	L3
8	Consider the system whose output is $y(t)=\cos\omega_c+x(t)$ determine where it is , i)memoryless ii)causal iii)linear iv)time invarient v)stable	5	CO1	L3
9	Sketch the signal for the following function, $x(t) = 2t$ for t varies from 0 to 1 and $x(t)=4-2t$ for t varies from 1 to 2. determine the odd component of x(t).	5	CO1	L3
10	Given x(n)=[3 2 1 0 1 2 3] and y(n)= [-1 -1 -1 -1 0 1 1 1 1] plot x(n-2)+y(n+2)	5	CO1	L3
11	Determine whether the following systems are time variant or time -invariant. i) $y(t)=tx(t)$ ii)$y(n)=x(2n)$	5	CO1	L3
12	Determine whether the following signal is periodic. If periodic , determine the fundamental period: $X(t)=3\cos t+4\cos(t/2)$ $X(t)=\cos 60\pi t+\sin 50\pi t$	5	CO1	L3
13	Determine the power and RMS value of the following signals. i) $x_1(t)=5\cos(50t+\pi/3)$ ii) $x_2(t)= 20\cos 50t\cos 15t$	5	CO1	L3
14	Determine whether the following systems are linear,time invariant,causal ,stable. $y(n)=\log(x(n))$.	5	CO2	L3
15	Determine whether the following systems are linear or not $dy(t) / dt + 3ty(t) = t2\ x(t)$ & $y(n)=2x(n)+ 1 / x(n-1)$	5	CO2	L3
16	Determine whether the following system is linear, time invariant, causal, stable and static 1. $y(n) = x2\ (n)$ 2. $y(n) = x(-n)$	5	CO2	L3
17	A discrete time signal is given by x(n)={1,1,1,1,2} Sketch the following signals a)x(n-2) b)x(n+1) c)x(3-n) d)x(n)u(n-1) e)x(n-1)δ(n-1) f)Even samples of x(n) g)odd samples of x(n)	5	CO2	L3
18	Determine whether the system is i) Linear ii) Time Invariant iii) memoryless iv) causal v) stable i) $y(t)=d/dt\{e^{-t}\ x(t)\}$ ii) $y(n)=x(k+2)$	5	CO2	L3
19	Draw the signal i)$x(t)=3r(t-1)-4r(t-2)-6r(t-3)+r(t)$ ii)$Y(t)=\{[x(t)+x(2-t)]u(1-t)\}u(t)$	5	CO2	L4
20	Define signals and systems, with appropriate examples?	5	CO2	L4
21	Write a note on classification of signals with suitable examples?	5	CO2	L3
22	Distinguish between: i) Energy signal and Power signal ii)Continuous and Discrete time signals iii) Even and Odd signal iv)Periodic and non periodic signals	5	CO2	L3
23	Determine the even and Odd components of the signal i) $x(t)=1+t^2+t\ \tan t+\tan^2 t\ \cot t + \cot^3 t$ ii) $x(t)=[\sin t+\cos t]^3$	5	CO2	L3
24	Define signals ?	5	CO2	L3

25	The impulse response of a continuous time LTI system is given by $h(t)=e^{2t}u(t-1)$ check whether the system is stable causal and memoryless.	5	CO2	L3
26	A continuous time LTI system with unit impulse response $h(t)=u(t)$ and input $x(t)=e^{-at}$ $u(t)$ $a>0$ find the output $y(t)$ of the system.	5	CO2	L3
27	Find the step response for the LTI system represented by the impulse response $h(n)=(1/2)^n$ $u(n)$.	5	CO2	L3
28	consider a continuous time LTI system is represented by the impulse response $h(t)=e^{-3t}$ $u(t-1)$ determine whether it is i)stable ii) causal	5	CO2	L3
29	Solve the differential equation, $d^2y(t)/dt^2 + 3\ dy(t)/dt + 2y(t) = 2x(t)$ with $y(0)=-1$ $dy(t)/dt$ with $t=0$ and $x(t)=cost\ u(t)$	5	CO2	L3
30	The impulse response of a continuous time LTI system is given by $h(t)=e^{2t}u(t-1)$ check whether the system is stable,causal and memoryless.	5	CO2	L3
31	Find the response of the system described by difference equations $y(n)-1/9\ y(n-2)=x(n-1)$ with $y(-1)=1$, $y(-2)=0$ and $x(n)=u(n)$	5	CO2	L3
32	find the difference equation representation for the block diagram representation of continuous time LTI system shown in figure 3c,  Fig.Q3(c)	5	CO2	L3
33	Determine the conditions so that the continuous time system with impulse response $h(t)=e^{at}u(-t)$ is stable. Also find out whether the system is i)causal ii) memoryless	5	CO2	L3
34	Represent the differential equation given below in direct form I and II$d^2y(t)/dt^2 + 3\ dy(t)/dt + 2y(t) = d^2y(t)/dt^2 + dx(t)/dt^2$	5	CO2	L3
35	Find the zero input response and forced response for the system described by the difference equation $y(n)-1/4\ y(n-2)=2x(n)+x(n-1)$ given $x(n)=u(n)$; $y(-2)=8$,$y(-1)=0$.	5	CO2	L3
36	For the given impulse response determine whether system is memory less, stable and causal justify your answer $h(n)=2^n$ $u(-n)$	5	CO2	L3
37	Given impulse response of the system $h(n)=(1/2)^n$ $u(n-2)$ find out step response of the system.	5	CO2	L3
38	Draw direct form-I and direct form- II implementation for the following difference equation $y(n)-1/4\ y(n-1)-1/8y(n-2)=2x(n)+3x(n-1)$	5	CO2	L3
39	Find the step response of a LTI system if impulse response $h(t)=t^2$ $u(t)$	5	CO2	L3
40	Obtain the response of the system given by $d^2y(t)/dt^2\ y(t) + y(t) = 3\ dx(t)/dt$ with $y(0)=-1$, $dy(t)/dt = d^2y(t)/dt^2=1$ and $2e^{-t}$ $u(t)$	5	CO2	L3
41	Find the difference equation for the system shown in fig.  Fig.Q.3(c)	5	CO2	L3

D2. TEACHING PLAN - 2

Module – 3

Title:		Appr Time:	10 Hrs

a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
	Resolve the signals in frequency domain using Fourier transform of continuous time signal	CO3	L2
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
21	LTI system Properties in terms of impulse response:	CO3	L2
22	System interconnection,	CO3	L2
23	Memory less, Causal, Stable, Invertible	CO3	L2
24	Deconvolution,	CO3	L2
25	step response	CO3	L2
26	Fourier Representation of Periodic Signals:	CO3	L2
27	CTFS definition	CO3	L2
28	CTFS Properties	CO3	L2
29	Problems	CO3	L2
30	Problems	CO3	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Radars, Digital filter design	1	L2
2	Distance phone calls, Digital recording, image processing	2	
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	State & prove the following properties of FT. i) Time shifting property ii) parseval's theorem.	CO3	L2
2	Obtain the fourier transform of x(t) = $te^{-at}u(t)$	CO3	L2
3	Find the fourier transform of rectangular pulse shown below x(ω) = $1/(a+j\omega)^2$	CO3	L2
4	Find the frequency response & impulse response of the system described by differential equation dy(t)/dt + 8y(t) =x(t)	CO3	L2
5	Find the Fourier transform of i) x(t)= t2 u(t) u(1-t) and ii) x(t)= t exp(- t) u(t) , >0	CO3	L2
6	Find the fourier transform of triangular pulse (10) x(t) = _(t/m) =[102|t|/m |t| 0 otherwise	CO3	L2
7	Obtain the exponential Fourier series of the waveform 	CO3	L2
8	Find the Fourier transform of rectangular pulse. Sketch the signal and its Fourier transform	CO3	L2
9	Find the Fourier transform of a triangular pulse.	CO3	L2
10	State and prove following properties of Fourier Transformation. i) Frequency shift ii) Convolution theorem.	CO3	L2
11	Determine Fourier transformation of following signals. i) x(t) = e-at u(t) ii) x(t) = cost \Wot.	CO3	L2
12	Find the frequency response and the impulse response of the system described by the differential equation. d^2 y/dt^2 +5d y/dt +6y =-d /dt x(t).	CO3	L2
13	State and explain parsavel's theorem	CO3	L2
14	Obtain the fourier transform of the following signal i)x(t)=e^{-at} u(t);a>0 ii)x(t)=delta(t)	CO3	L2
15	The impulse response of continuous time signal is given by h(t)=1/Re e-t/RC u(t) find the frequency response and plot the magnitude	CO3	L2

Module – 4

Title:	Data Transmission and Telemetry Measurement of Non – Electrical Quantities	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
	Apply Discrete time Fourier transform representation to study and resolve the signal and system	CO4	L3
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
31	Fourier Representation of aperiodic Signals:	CO4	L3
32	Introduction to Fourier Transformsignals: The	CO4	L3
33	Introduction to DTFT	CO4	L3
34	Problems on FT	CO4	L3
35	Problems on DTFT	CO4	L3
36	Properties of Fourier Transform: Linearity, Time shift,	CO4	L3
37	Frequency shift, Scaling, Differentiation and Integration,	CO4	L3
38	Convolution and Modulation,	CO4	L3
39	Parseval?s theorem	CO4	L3
40	Problems	CO4	L3
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Amplitude modulation, frequency multiplexing	CO4	L3
2	Circuit analysis, sampling	CO4	L4
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	State and explain following DTFT properties I) Time shift ii) Linearity	CO4	L3
2	Determine the DTFT of the following signal, i)x(n)=u(n) ii) x(n)=2^n u(-n)	CO4	L3
3	Obtain the frequency response of the impulse response of the system described by the difference equation y(n)-1/4 y(n-1)=3x(n)-3/4 x(n-1)	CO4	L3
4	Define Transfer function of the DT system and Define impulse response of a DT system	CO4	L3
5	State the significance of difference equations and Write the differece equation for Discrete time system	CO4	L3
6	Define frequency response of the DT system and explainWhat is the condition for stable system	CO4	L3
7	Obtain the DTFT of the signal x[n] =2n u(-n)	CO4	L3
8	State & prove the following properties of DTFT. i) Convolution property ii) Frequency differentiation	CO4	L3
9	Using DTFT find the total solution to the difference equation for discrete time signal. 5y(n+2) – 6y(n+1) +y(n) = 0.8 u(n)	CO4	L3
10	Find the fourier transform of the following. x(n) = 1 ; -2 ≤ n≤ 2 = 0 ; Otherwise	CO4	L3
11	Find the fourier transform of x[n] = an u[n] for -13. Determine the fourier transform of the discrete time rectangular pulse of amplitude A and length L i.e x[n] = A for 0= n=L-1 0 otherwise	CO4	L3
12	Determine the discrete time sequence where DTFT is given as X(w) = 1 for –wc = w = wc 0 for wc < | w | ?	CO4	L3
13	Find the DTFT of the signal x(n)= $a^{\|n\|}$; |a|<1	CO4	L3
14	Find the inverse DTFT of the signal X($e^{j\Omega}$)=3-(1/4 $e^{-j\Omega}$)/-1/16 $e^{-2j\Omega}$ +1	CO4	L3
15	Find the impulse response of the system having output y(n)-1/4(1/2)^n u(n)	CO4	L3

	+(1/4)^n u(n)		
16	Obtain the difference equation for the system with frequency response h(e$^{j\Omega}$)=1+e$^{-j\Omega}$/(1-(1/2 e$^{-j\Omega}$))(1=(1/24e$^{-j\Omega}$))	CO4	L3
e	**Experiences**	-	-
1		CO7	L2
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

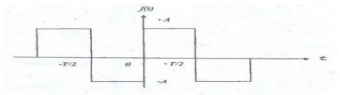
Crs Code:	18EC45	Sem:	IV	Marks:	30	Time	90 minutes
Course:	Signals & Systems						

-	-	**Note: Answer all questions, each carry equal marks. Module : 3, 4**	**Marks**	**CO**	**Level**
1	a	Determine Fourier transformation of following signals. i) x(t) = e^{-at} u(t) ii) x(t) = cost Wot.	5	CO3	L1
	b	Find the frequency response and the impulse response of the system described by the differential equation. d^2 y/dt^2 +5d y/dt +6y =-d /dt x(t).	4	CO3	L2
	c	Find the DTFT of the signal x(n)= a$^{\|n\|}$; |a|<1	3	CO3	L2
	d	Find the fourier transform of the following. x(n) = 3; -4 ≤ n≤ 24 = 0 ; Otherwise	3	CO3	L2
2	a	State and explain parsavel's theorem	3	CO3	L3
	b	Obtain the fourier transform of the following signal i)x(t)=e^{-at} u(t);a>0 ii)x(t)=delta(t)	4	CO3	L3
	c	The impulse response of continuous time signal is given by h(t)=1/Re e$^{-t/RC}$ u(t) find the frequency response and plot the magnitude	3	CO3	L2
	d	Find the inverse DTFT of the signal X(e$^{j\Omega}$)=3-(1/4 e$^{-j\Omega}$)/-1/16 e$^{-2j\Omega}$ +1	5	CO3	L2
3	a	State and explain following DTFT properties I) Time shift ii) Linearity	3	CO4	L3
	b	Determine the DTFT of the following signal, i)x(n)=u(n) ii) x(n)=2^n u(-n)	4	CO4	L3
	c	Obtain the frequency response of the impulse response of the system described by the difference equation y(n)-1/4 y(n-1)=3x(n)-3/4 x(n-1)	5	CO4	L3
	d	Find the fourier transform of the following. x(n) = 1 ; -2 ≤ n≤ 2 = 0 ; Otherwise	3	CO4	L3
4	a	Obtain the DTFT of the signal x[n] =2n u(-n)	3	CO4	L3
	b	State & prove the following properties of DTFT. i) Convolution property ii) Frequency differentiation	4	CO4	L3
	c	Using DTFT find the total solution to the difference equation for discrete time signal. 5y(n+2) – 6y(n+1) +y(n) = 0.8 u(n)	4	CO4	L3
	d	Obtain the difference equation for the system with frequency response h(e$^{j\Omega}$)=1+e$^{-j\Omega}$/(1-(1/2 e$^{-j\Omega}$))(1=(1/24e$^{-j\Omega}$))	5	CO4	L3

b. Assignment – 2

Model Assignment Questions							
Crs Code:		Sem:		Marks:		Time:	
Course:							

SNo	**Assignment Description**	**Marks**	**CO**	**Level**
1	State & prove the following properties of FT. i) Time shifting property ii) parseval's theorem.	7	CO3	L2

2	Obtain the fourier transform of x(t) = te-atu(t)	8	CO3	L2
3	Find the fourier transform of rectangular pulse shown below x(ω) = 1/(a+jω) ²	7	CO3	L2
4	Find the frequency response & impulse response of the system described by differential equation dy(t)/ dt + 8y(t) =x(t)	8	CO3	L2
5	Find the Fourier transform of i) x(t)= t2 u(t) u(1-t) and ii) x(t)= t exp(- t) u(t) , >0	7	CO3	L2
6	Find the fourier transform of triangular pulse (10) x(t) = _(t/m) ={102|t|/m |t| 0 otherwise	8	CO3	L2
7	Obtain the exponential fourier series of the waveform 	5	CO3	L2
8	Find the Fourier transform of rectangular pulse. Sketch the signal and its Fourier transform	6	CO3	L2
9	Find the Fourier transform of a triangular pulse.	7	CO3	L2
10	Obtain the DTFT of the signal x[n] =2n u(-n)	8	CO3	L2
11	State & prove the following properties of DTFT. i) Convolution property ii) Frequency differentiation	7	CO3	L2
12	Using DTFT find the total solution to the difference equation for discrete time signal. 5y(n+2) – 6y(n+1) +y(n) = 0.8 u(n)	8	CO3	L2
13	Obtain the difference equation for the system with frequency response $h(e^{j\Omega})=1+e^{-j\Omega}/(1-(1/2\ e^{-j\Omega}))(1=(1/24e^{-j\Omega}))$	7	CO3	L2
14	State and explain following DTFT properties I) Time shift ii) Linearity	8	CO3	L2
15	Determine the DTFT of the following signal, i)x(n)=u(n) ii) $x(n)=2^n$ u(-n)	7	CO3	L2
16	Obtain the frequency response of the impulse response of the system described by the difference equation y(n)-1/4 y(n-1)=3x(n)-3/4 x(n-1)	8	CO3	L2
17	Find the fourier transform of the following. x(n) = 1 ; -2 ≤ n≤ 2 = 0 ; Otherwise	7	CO3	L2
18	State and explain parsavel's theorem	8	CO3	L2
19	Obtain the fourier transform of the following signal i)$x(t)=e^{-at}$ u(t);a>0 ii)x(t)=delta(t)	7	CO3	L2
20	The impulse response of continuous time signal is given by $h(t)=1/Re\ e^{-t/RC}$ u(t) find the frequency response and plot the magnitude	8	CO3	L2
21	Find the inverse DTFT of the signal $X(e^{j\Omega})=3-(1/4\ e^{-j\Omega})/-1/16\ e^{-2j\Omega}+1$	7	CO4	L3
22	Determine Fourier transformation of following signals. i) x(t) = e-at u(t) ii) x(t) = cost Wot.	8	CO4	L3
23	Find the frequency response and the impulse response of the system described by the differential equation. d^2 y/dt^2 +5d y/dt +6y =-d /dt x(t).	7	CO4	L3
24	Find the DTFT of the signal $x(n)= a^{\|n\|}$; |a|<1	8	CO4	L3
25	Find the fourier transform of the following. x(n) = 1 ; -2 ≤ n≤ 2 = 0 ; Otherwise	7	CO4	L3
26	Determine the DTFT of the following signal, i)x(n)=u(n) ii) $x(n)=2^n$ u(-n)	8	CO4	L3
27	Obtain the frequency response of the impulse response of the system described by the difference equation y(n)-1/4 y(n-1)=3x(n)-3/4 x(n-1)	7	CO4	L3

28	Find the fourier transform of the following. x(n) = 4 ; -3 ≤ n≤ 3 = 0 ; Otherwise	8	CO4	L3
29	State and explain parsavel's theorem	7	CO4	L3
30	Obtain the fourier transform of the following signal i)x(t)=e^{-at} u(t);a>0 ii)x(t)=delta(t)	8	CO4	L3
31	Using DTFT find the total solution to the difference equation for discrete time signal. 5y(n+2) – 6y(n+1) +y(n) = 0.8 u(n)	7	CO4	L3
32	Obtain the difference equation for the system with frequency response $h(e^{j\Omega})=1+e^{-j\Omega}/(1-(1/2\ e^{-j\Omega}))(1=(1/24e^{-j\Omega}))$	8	CO4	L3
33	State and explain following DTFT properties I) Time shift ii) Linearity	7	CO4	L3
34	Obtain the fourier transform of x(t) = te-atu(t)	8	CO4	L3
35	Find the fourier transform of rectangular pulse shown below $x(\omega) = 1/(a+j\omega)^2$	7	CO4	L3
36	Find the frequency response & impulse response of the system described by differential equation dy(t)/ dt + 8y(t) =x(t)	8	CO4	L3
37	Find the Fourier transform of i) x(t)= t2 u(t) u(1-t) and ii) x(t)= t exp(- t) u(t) , >0	7	CO4	L3
38	Find the fourier transform of triangular pulse x(t) =(t/m) =[102| t|/m |t| 0 otherwise	8	CO4	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	Loop and Horn Antenna and Antenna Types	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
	Explain the need of real time operating system for embedded system applications. Apply z-transform and its properties for the analysis of discrete time system using partial fraction expansion method.		L3
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
41	IThe Z-Transforms-Definition	CO5	L3
42	ROC, properties of the region of convergence,	CO5	L3
43	properties of the Z-transform,	CO5	L3
44	properties of the Z-transform	CO5	L3
45	iInverse Z-transform,	CO5	L3
46	Causality and stability,	CO5	L3
47	Transform analysis of LTI systems	CO5	L3
48	Transform analysis of LTI systems.,	CO5	L3
49	Problems	CO5	L3
50	Problems.	CO5	L3
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Analysis of digital system,system design,automatic controls in telecommunication.	CO5	L3
2	Simulate the continuous system, Analysis of digital filters	CO5	L4

d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Define Z-Transform for a general discrete time signal x[n].	CO5	L1
2	What is ROC w.r.t. Z-Transform?	CO5	L3
3	What are the properties of ROC?	CO5	L2
4	What are the properties of Z-Transforms?	CO5	L3
5	State and prove the properties of Unilateral Z-Transform and ROC.	CO5	L3
6	Find the Z-Transform of x[n] = -u(n-1)+$(1/2)^n$ u(n)	CO5	L4
7	Determine the Z-Transform, ROC, pole and zero locations for the following signals: a) x(n) = $(1/2)^n$ u(n) + $(-1/3)^n$ u(n) b)x(n) =$e^{j\Omega 0^n}$ u(n)	CO5	L3
8	Find the inverse Z-Transform of ,H(Z) = $(1+Z^{-1})/ (1-0.9e^{j\pi/4} Z^{-1})(1-0.9e^{-j\pi/4} Z^{-1})$	CO5	L3
9	Find the inverse Z-Transform assuming a) Signal is causal; b) Signal has DTFT 1/ $(1-1/2\ Z^{-1}) + 2/(1-2Z^{-1})$	CO5	L3
10	A system is described by the difference equation y[n] – y[n-1] + 1/4 y[n-2] = x[n] + 1/4 x[n-1] – 1/8 x[n-2] a) Find the Transfer Function of the Inverse System. b) Does a stable and causal inverse system exist?	CO5	L3
11	Define Z transform?What are the two types of Z transform? Define unilateral Z transform.	CO5	L3
12	What is region of Convergence and What are the Properties of ROC.	CO5	L3
13	What is the time shifting property of Z transform, differentiation property in Z domain, convolution property of Z transform..	CO5	L3
14	State the methods to find inverse Z transform.	CO5	L3
15	State and prove parseval's relation for Z transform	CO5	L3
e	**Experiences**	-	-
1		CO10	L2
2		CO9	

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	18EC45	Sem:	IV	Marks:	30	Time:	75 minutes
Course:	Signals & Systems						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Find the Z-transform of the sequence, and sketch the ROC and pole zero location i) x(n)=$(1/3)^n$ sin(Π/4 n) u(n) ii)x(n)=a^nu(n)+b^nu(-n-1)	8	CO5	L1
	b	What is ROC with respect to Z-transform? What are its properties	7	CO5	L2
2	a	Find the inverse z transform of the following by partial fraction method X(z)=$(z^4 + z^2) / (z^2-3/4\ z+1/8)$ |z|>1/2	8	CO5	L2
	b	Find the inverse Z transform of X(Z) by power series expansion method X(Z)= $1/ 1-1.5Z^{-1}+0.5Z^{-2}$ ROC: |Z|<1	7	CO5	L4
3	a	A difference equation of the system is given as below determine the transfer function of the inverse system. Check whether the inverse system is causal and stable. y(n)-y(n-1)+1/4 y(n-2)=x(n)+1/4 x(n-1)-1/8x(n-2)	8	CO5	L1
	b	Determine the forced response for the following system y(n)-5/6 y(n-1)+1/6 y(n-2)=x(n) if input x(n)=2^nu(n)	7	CO5	L2
4	a	Solve the following difference equation y(n)-1/9 y(n-2)=x(n-1) with y(-1)=0, y(-2)=1 & x(n)=3u(n)	8	CO5	L2
	b	Explain the following properties i) Convolution property ii) Initial value theorem	7	CO5	L2

b. Assignment – 3

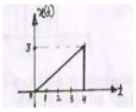
Model Assignment Questions							
Crs Code:	18EC45	Sem:	IV	Marks:	30	Time:	90 minutes
Course:	Signals & Systems						

SNo	Assignment Description	Marks	CO	Level
1	Determine the transfer function and impulse response for the causal LTI system described by the equation using Z transform Y(n) – 1/4y(n-1)-3/8y(n-2) = -x(n) + 2x(n-1)	5	CO5	L3
2	Find the inverse Z Transform of X(z) = 1/(1-0.5Z^{-2}–1 + 0.5Z^{-1}–2) for ROC |Z| >1	5	CO5	L3
3	Find the Z-transform of the following i) x(n) = 2n u(-n-1) ii) x(n) = (3)2n u(-n)	5	CO5	L3
4	Solve the following difference equation using unilateral Z-transform Y(n) + 3y(n-1) = x(n) with x(n) = u(n) and the initial condition y(-1) =1	5	CO5	L3
5	Prove the following properties of Z-transform i) Linearity ii) Initial value theorem	5	CO5	L3
6	Find Inverse Z-transform of the following using partial fraction expansion method. X(z) = (1+2z-1+z-2)/(1-1.5z-1+0.5z-2)	5	CO5	L3
7	Check whether the system is causal or not ,the H(z) is given by (z3 + z)/(z+1). ii) H(z) is given by (z/z0a).,|a|<1.	5	CO5	L3
8	Determine the transfer function for the system described by the difference equation y(n)$_0$ y(n$_0$1) = x(n)$_0$ x(n$_0$2).	5	CO5	L3
9	find the inverse z-transform of x(z)= 1+3z-1 / 1+ 3z-1 + 2z-2 using residue method	5	CO5	L3
10	Determine the inverse z transform of the following function x(z)=1/(1+z-1)(1-z-1)2 ROC : |Z>1|	5	CO5	L3
11	Find the Z – transform of the signal (8) (i)x(n)= u(n) (ii)x(n)= A cos(ω_0) u(n)	5	CO5	L3
12	Find the Unilateral Z-transform and R.O.C of x(n) = sin ω0 n u(n)	5	CO5	L3
13	What is the time shifting property, differentiation property and convolution property of Z transform .	5	CO5	L3
14	State parseval's relation for Z transform	5	CO5	L3
15	Define Z transform?What are the two types of Z transform? Define unilateral Z transform	5	CO5	L3
16	Find the Z-transform of the sequence, and sketch the ROC and pole zero location i) x(n)=(1/3)^n sin(Π/4 n) u(n) ii)x(n)=a^{n}u(n)+b^{n}u(-n-1)	5	CO5	L3
17	What is ROC with respect to Z-transform? What are its properties	5	CO5	L3
18	Find the inverse z transform of the following by partial fraction method X(z)=(z^4 + z^2) / (z^2-3/4 z+1/8) |z|>1/2	5	CO5	L3
19	Find the inverse Z transform of X(Z) by power series expansion method X(Z)= 1/ 1-1.5Z^{-1}+0.5Z^{-2} ROC: |Z|<1	5	CO5	L3
20	Define Z-Transform for a general discrete time signal x[n].	5	CO5	L3
21	What is ROC w.r.t. Z-Transform?	5	CO5	L3
22	What are the properties of ROC?	5	CO5	L3
23	What are the properties of Z-Transforms?	5	CO5	L3
24	State and prove the properties of Unilateral Z-Transform and ROC.	5	CO5	L3
25	Find the Z-Transform of x[n] = -u(n-1)+(1/2)^n u(n)	5	CO5	L3
26	Determine the Z-Transform, ROC, pole and zero locations for the following signals: a) x(n) = (1/2)^n u(n) + (-1/3)^n u(n) b)x(n) =$e^{j\Omega}$ 0^n u(n)	5	CO5	L3
27	Find the inverse Z-Transform of ,H(Z) = (1+Z^{-1})/ (1-0.9$e^{j\pi/4}$ Z^{-1})(1-0.9$e^{-j\pi/4}$ Z^{-1})	5	CO5	L3
28	Find the inverse Z-Transform assuming a) Signal is causal; b) Signal has	5	CO5	L3

	DTFT $1/(1-1/2\ Z^{-1}) + 2/(1-2Z^{-1})$			
29	A system is described by the difference equation y[n] – y[n-1] + 1/4 y[n-2] = x[n] + 1/4 x[n-1] – 1/8 x[n-2] a) Find the Transfer Function of the Inverse System. b) Does a stable and causal inverse system exist?	5	CO5	L3
30	Define Z-Transform for a general discrete time signal x[n].	5	CO5	L3

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Signals & Systems							
Crs Code:		18EC45	Sem:	4	Marks:	60			
-	**Note**	Answer all FIVE full questions. All questions carry equal marks.							**Marks**
1	a	Distinguish between i) Even and Odd Signals ii) Periodic and nonperiodic signals					CO1	L2	4
	b	b. Determine whether the following signals are periodic, if periodic determine the fundamental period. i) x(t) = cos2t + sin3t ii)x[n] = sin2n					CO1	L3	4
	c	c. Sketch the following signal for x(t) is shown in figure. i) x(3t+2) ii) x(2(t +2) iii) x(-2t-1) iv) x(-2t+3) 					CO1	L3	8
2	a	a. Find total energy of the following signals i) x(t) = A ; -T/2 < t < T/2 ii) $x(t)=\begin{cases}\frac{1}{2}[\cos(\omega t)+1] & \frac{-\pi}{\omega}\le t\le \pi/\omega \\ 0 & \text{otherwise}\end{cases}$ = 0 ; Otherwise					CO1	L3	8
	b	Dete ı2) is i) Linear ii) Time-invarient iii) Memory iv) Causal v) Stable					CO1	L3	8
		OR							
3	a	Consider an LTI system with input x(n) & unit impulse response h(n) given below, Compute y(n). x(n) = 2n u(-n); & h(n) = u(n)					CO2	L3	8
	b	Find the step response for the LTI system represented by impulse response i) h(n) = u(n) ii) h(n) = (1/2)n u(n)					CO2	L3	4
	c	Determine stability & causality of the following i) h(n) = (1/2)n u(n) ii) h(t) = e-3tu(t-1)					CO2	L3	4
		OR							
4	a	Find Forced response of the following system given by y(n) – 5/6 y(n-1) + 1/6 y(n-2) = x(n) where $x(n) = 2^n$					CO2	L3	10
	b	Draw direct form-I & II structures for the system described by the differential equation. $\frac{d^3y(t)}{dt^3}+\frac{2dy(t)}{dt}+3y(t)=x(t)+\frac{3dx(t)}{dt}$					CO2	L3	6
5	a	State & prove the following properties of FT. i) Time shifting property ii) parseval's theorem					CO3	L3	10
	b	Obtain the fourier transform of $x(t) = te^{-at}u(t)$					CO3	L3	6
		OR							
6	a	Find the fourier transform of rectangular pulse shown below $x(\omega) = 1/(a+j\omega)^2$					CO3	L3	8
	b	Find the frequency response & impulse response of the system described by differential equation. dy(t)/dt + 8y(t) =x(t)					CO3	L3	8
7	a	Obtain the DTFT of the signal x[n] =2n u(-n)					CO4	L2	6
	b	State & prove the following properties of DTFT. i) Convolution property ii) Frequency differentiation.					CO4	L3	10
		OR							

8	a	Using DTFT find the total solution to the difference equation for discrete time signal. $5y(n+2) - 6y(n+1) + y(n) = 0.8\,u(n)$	CO4	L3	8
	b	Find the fourier transform of the following. $x(n) = 1 ; -2 \le n \le 2$ $= 0 ;$ Otherwise	CO4	L3	8
9	a	Find the Z-transform of the following i) $x(n) = 2n\,u(-n-1)$ ii) $x(n) = (3)2n\,u(-n)$	CO5	L3	8
	b	Prove the following properties of Z-transform i) Linearity ii) Initial value theorem	CO5	L3	8
		OR			
10	a	Find Inverse Z-transform of the following using partial fraction expansion method. $X(z) = (1+2z^{-1}+z^{-2})/(1-1.5z^{-1}+0.5z^{-2})$	CO5	L3	8
	b	Solve the following difference equation using unilateral Z-transform $Y(n) + 3y(n-1) = x(n)$ with $x(n) = u(n)$ and the initial condition $y(-1) = 1$	CO5	L3	8
	b	With FSM model, explain the design and operation of automatic tea/ coffee vending machine.	CO5	L3	5
	c	Explain the assembly language based embedded firmware development with a diagram and mention its advantages and disadvantages.	CO5	L3	7

2. SEE Important Questions

Course:		Signals & Systems						Month / Year	May /2018	
Crs Code:		18EC45	Sem:	4	Marks:	60		Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.						-	-	
Module	Qno.	Important Question						**Marks**	**CO**	**Year**
1	1	Distinguish between: i) Energy signal and Power signal ii)Continuous and Discrete time signals iii) Even and Odd signal iv)Periodic and non periodic signals						6	CO1	2018
	2	Determine the even and Odd components of the signal i) $x(t)=1+t^2+t\,\tan t+\tan^2 t\,\cot t + \cot^3 t$ ii) $x(t)=[\sin t+\cos t]^3$						6	CO1	2018
	3	Determine whether the following signals are periodic, if periodic determine the fundamental period i) $x(t)=[2\cos^2(\pi t/2)-1]\sin\pi t\,\cos\pi t$ ii) $x(n)=\cos(\pi n/7)\,\sin(\pi n/3)$						6	CO1	
	4	Determine the following signal is Energy or Power signal i) $x(t)=e^{-a\lvert t\rvert}$ $a>0$ ii) $x(t) =$ $5+t$ for $(-5,-4)$; 1 for $(-4, 4)$; $5-t$ for $(4, 5)$; 0 otherwise						6	CO1	2018
	5	Determine whether the system is i) Linear ii) Time Invariant iii) memoryless iv) causal v) stable i) $y(t)=d/dt[e^{-t}\,x(t)]$ ii) $y(n)=x(k+2)$						6	CO1	2018
2	1	The impulse response of a continuous time LTI system is given by $h(t)=e^{2n}u(n-1)$ and the input $x(n)= 2u(n)+5u(n-1)$						8	CO2	2018
	2	A continuous time LTI system with unit impulse response $h(t)=u(t)$ and input $x(t)=e^{-at}\,u(t)$ $a>0$ find convolution of the signals						6	CO2	2018
	3	Find the step response for the LTI system represented by the impulse response $h(n)=(1/2)^n\,u(n)$.						8	CO2	2018
	4	consider a continuous time LTI system is represented by the impulse response $h(t)=e^{-3t}\,u(t-1)$ determine whether it is i)stable ii) causal						6	CO2	2018
	5	Solve the differential equation, $d^2y(t)/dt^2 + 3\,dy(t)/dt + 2y(t) = 2x(t)$ with $y(0)=-1$ $dy(t)/dt$ with $t=0$ and $x(t)=\cos t\,u(t)$						8	CO2	2018

3	1	Determine Fourier transformation of following signals. i) x(t) = e-at u(t) ii) x(t) = cost wot.	6	CO3	2018
	2	Find the frequency response and the impulse response of the system described by the differential equation. d^2 y/dt^2 +5d y/dt +6y =-d /dt x(t).	8	CO3	2018
	3	State and explain parsavel's theorem	6	CO3	2018
	4	Obtain the fourier transform of the following signal i)x(t)=e^{-at} u(t);a>0 ii)x(t)=delta(t)	8	CO3	2018
	5	obtain the fourier transform of x(t) = $te^{-at}u(t)$	6	CO3	2018
4	1	State and explain following DTFT properties I) Time shift ii) Linearity	6	CO4	2018
	2	Determine the DTFT of the following signal, i)x(n)=u(n) ii) x(n)=2^n u(-n)	6	CO4	2018
	3	Obtain the frequency response of the impulse response of the system described by the difference equation y(n)-1/4 y(n-1)=3x(n)-3/4 x(n-1)	8	CO4	2018
	4	Find the fourier transform of the following. x(n) = 1 ; -2 ≤ n≤ 2 = 0 ; Otherwise	6	CO4	2018
	5	Obtain the DTFT of the signal x[n] =2n u(-n)	6	CO4	2018
5	1	Find the inverse Z-Transform assuming a) Signal is causal; b) Signal has DTFT 1/(1-1/2 Z^{-1}) + 2/(1-2Z^{-1})	5	CO5	2018
	2	What is z-transformation? List the properties of ROC. State and prove following properties i) Convolution ii) Time reversal	8	CO5	2018
	3	Find Inverse Z-transform of the following using partial fraction expansion method. X(z) = $(1+2z^{-1}+z^{-2})/(1-1.5z^{-1}+0.5z^{-2})$	6	CO5	2018
	4	Solve the following difference equation using unilateral Z-transform Y(n) + 3y(n-1) = x(n) with x(n) = u(n) and the initial condition y(-1) =1	6	CO5	2018
	5	Find the z-transformation of i) x(n) = n a nu(-n) ii) x(n) = n sin (∏/2n)u(-n)	8	CO5	2018
	b	Mention the sequence of operations for embedding the firmware with a programmer and draw the interfacing diagram.	6	CO5	2018

Course Outcome Computation

Academic Year:

Odd / Even semester

INTERNAL TEST					**T1**						**T2**	
Course Outcome	**CO1**		**CO2**		**CO3**		**CO4**		**CO5**		**CO6**	
QUESTION NO	**Q1**	**LV**	**Q2**	**LV**	**Q3**	**LV**	**Q1**	**LV**	**Q2**	**LV**	**Q3**	**LV**
MAX MARKS	10	-	10	-	10	-	10	-	10	-	10	-
USN-1	5	2	10				10	3	9	3	4	1
USN-2	5	2	8	3								
USN-3	7	3	7	3	10	3	8	3	8	3	5	2
USN-4					4	1	10	3	8	3	6	2
USN-5	8	3	6	2	9	3	10	3	8	3		
USN-6							10	3	9	3	4	1
Average CO Attainment		2.5		2.75		2.33		3		3		1.5

LV Threshold : 3:>60%, 2:>=50% and <=60%, 1: <=49%
CO1 Computation :(2+2+2+3)/4 = 10/4=2.5

PO Computation

Program Outcome	PO1	PO3	PO3	PO1	PO12	PO12
Weight of CO - PO	3	1	3	2	2	3
Course Outcome	CO1	CO2	CO3	CO4	CO5	CO6

Test/Quiz/Lab	T1						T2					
QUESTION NO	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV	Q3	LV
MAX MARKS	10	-	10	-	10	-	10	-	10	-	10	-
USN-1	5	2	10	3			10	3	9	3	4	1
USN-2	5	2	8	3								
USN-3	7	3	7	3	10	3	8	3	8	3	5	2
USN-4					4	1	10	3	8	3	6	2
USN-5	8	3	6	2	9	3	10	3	8	3		
USN-6							10	3	9	3	4	1
Average CO Attainment		2.5		2.75		2.33		3		3		1.5