KL UNIVERISTY
FIRST SEMESTER 2010-11
Course Handout
Academic Division

Dated: 07-07-2010

Course No. : **EM C204 / EC C204**
Course Title : **Signals and Systems**
Course Structure : **3-0-2**
Course coordinator : **I Govardhani**
Instructors : **KVL Bhavani, T K Sasanka, G.Chenchamma, P.Praveen Kumar, M.Vidyasree, K. Ravikumar, KVL Bhavani, , Mary Sylvia, T. Ramesh, Ch. Srikavya, S.Jayalkshmi, U. Swathi,**

1. Course Description:

The approach to signals and systems had been guided by the continuing developments in technologies for signal and system design and implementation, which made it increasingly important for a student to have equal familiarity with techniques suitable for analyzing and synthesizing both continuous-time and discrete-time systems.

Thus, while students studying signals and systems should certainly have a solid foundation in disciplines based on the laws of physics, they must also have a firm grounding in the use of computers for the analysis of phenomena and the implementation of systems and algorithms. As a consequence, engineering curricula now reflect a blend of subjects, some involving continuous-time models and others focusing on the use of computers and discrete representations.

For these reasons, signals and systems courses that bring discrete-time and continuous-time concepts together in a unified way play an increasingly important role in the education of engineering students and in their preparation for current and future developments in their chosen fields.

It is with these goals in mind that this course has been structured to develop in parallel the methods of analysis for continuous-time and discrete-time signals and systems. This approach also offers a distinct and extremely important pedagogical advantage. Specifically, we are able to draw on the similarities between continuous- and discrete-lime methods in order to share insights and intuition developed in each domain. Similarly, we can exploit the differences between them to sharpen an understanding of the distinct properties of each.

This course provides the student with an appreciation for the range of applications of the techniques being learned and for directions for further study. To achieve this goal we include introductory treatments on the subjects of filtering, communications, sampling, discrete-time processing of continuous-time signals and feedback.

2. Scope and Objective of the Course:

These kinds of courses are frequently found in electronics engineering curricula, where the concepts and techniques that form the core of the subject are of fundamental importance in all engineering disciplines. In fact, the scope of potential and actual applications of the methods of signal & system analysis continuous to expand as engineers is confronted with new challenges involving the synthesis or analysis of complex processes. For these reasons, a course in signals & systems not only is an essential element in an engineering program, but also can be one of the

most rewarding, exciting and useful courses that engineering students take during their undergraduate education.

In Signals and Systems, a unified treatment of the analysis of Linear Systems, Fourier series, Fourier transforms, Laplace transform, z - transform Convolution and Discrete time systems is aimed at. The importance of signal analysis in modern theory cannot be overstressed. The study of Signals leads into the analysis of Linear Systems and Frequency Transform methods on one hand and on the other hand it leads directly into Signal applications.

Unit I deals with Signal analysis in which approximation of a function by a set of mutually orthogonal functions, Trigonometric and Exponential representation by Fourier series and also Properties of continuous and discrete Fourier series is discussed in detail.

Unit II covers main topics like Linear Time Invariant systems analysis, Basic properties of the system, Convolution, Convolution by graphical method in detail.

Unit III deals sampling theorem and its importance, z-transforms, properties of z- transforms, Relationship between z-transform and Fourier transform.

Unit IV & V are detailed discussion of Discrete time systems, its properties, different forms of realization of discrete systems.

3. Books:

(i) Textbook:

a. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley, 1999
b. B.P.Lathi, "Signals, Systems and Communications", BSP, 2003
c. Alan V.Oppenheim, Alan S.Willsky with S.Hamid Nawab, "Signals & Systems", 2nd Edition, Pearson Education, 1997.

(ii) Reference Book:

a . Hwei P.Hsu, "Signals and Systems ", Schaum's outline series, MC Graw Hill, 1995
b. P.Ramesh Babu, "Signals and Systems", Scietech, 2008
c. Bernd Girod, "Signals and systems ", John Wiley & Sons Ltd, 2001

4. Syllabus:

UNIT – I

INTRODUCTION: Classification of Signals, Basic operation on Signals, Elementary Signals, Properties of Systems, Transformations of the Independent variable, Exponential and sinusoidal signals.

LINEAR TIME INVARIANT SYSTEMS: Introduction, Discrete time LTI Systems: The convolution sum, continuous Time LTI systems; The convolution integral, Properties of Linear Time Invariant systems, causal LTI systems Described by differential and Difference equations.

UNIT – II

FOURIER SERIES REPRESENTATION OF SIGNAL: Introduction, Fourier Series representation of continuous Time signals, convergence of the Fourier Series, Properties of continuous Time Fourier Series, Fourier Series representation of DT Signals, properties of DTFS.

UNIT – III

THE CONTINUOUS TIME FOURIER TRANSFORM: Introduction, Representation of Aperiodic Signal: The continuous Time Fourier Transform, The FT for periodic Signals, Properties of the CTFT, The convolution property, The multiplication Property , Systems characterized by Linear constant coefficient Differential equations.

SAMPLING: Representation of a continuous Time signals by its samples: The sampling theorem Reconstruction of a signal from its samples, The effect of Under sampling

UNIT –IV

THE LAPLACE TRANSFORM: Introduction, The Laplace transform, properties of the region of convergence, properties of the Laplace Transform, Inverse of the Laplace transform. The unilateral Laplace Transforms Analysis and characterization of LTI systems using Laplace Transform

REPRESENTATION OF SIGNALS USING DISCRETE COMPLEX EXPONENTIALS: The Z- transform, Introduction, The Z- transform, properties of the region of convergence, properties of the Z – transform, Inverse of the Z – transform. The unilateral Z – transform, Analysis and characterization of LTI systems using Z – transforms.

UNIT –V

THE DISCRETE TIME FOURIER TRANSFORM: Introduction, Representation of Aperiodic signals, The Fourier transform for periodic signals, properties of the DTFT, The convolution property, The multiplication property, Duality, systems characterized by linear constant –coefficient – Difference equations.

5.Course Plan:

Lecture No	Learning Objectives	Topic	Chapter in Text Book
1	Define Signals & Systems, Classify the signals	Introduction to Signals and Systems, Basic classification of Signals	T-3, Chap-1
2	understand different types of signals and basic operations on those	Basic operation on Signals & Elementary Signals	T-3, Chap-1
3	Analyze the properties of system under different conditions	Properties of Systems (systems with and with out memory, invertibility and inverse systems)	T-3, Chap-1
4	Analyze the properties of system under different conditions	Causality, stability, time invariance& linearity properties	T-3, Chap-1
5	Analyze the conversion techniques of independent variable	Transformations of the Independent variable	T-3, Chap-1
6	Understand the exponential and sinusoidal signals and response of the systems for those signals	Exponential and sinusoidal signals.	T-3, Chap-3
7	Analyze the LTI system For different signals	Introduction about linear time in variant system	T-3, Chap-3
8	Analyze the Discrete time LTI system and evaluate the convolution sum For different signals	Discrete time LTI Systems: The convolution sum	T-3, Chap-3

9	Analyze the continuous time LTI system and evaluate the convolution integral For different signals	continuous Time LTI systems; The convolution integral	T-3, Chap-3
10	understand and analyze the properties of LTI system.	Properties of Linear Time Invariant systems	T-3, Chap-3
11	Analyze the response of causal LTI system for differential and difference equation.	causal LTI systems Described by differential and Difference equations	T-3, Chap-3
12	Evaluate the Fourier series representation of a continuous time signal	Introduction, Fourier Series representation of continuous Time signals	T-3, Chap-3
13	Analyze the convergence of Fourier series	convergence of the Fourier Series	T-3, Chap-3
14	Understand the properties of continuous time Fourier series	Properties of continuous Time Fourier Series	T-3, Chap-4
15	Understand the properties of continuous time Fourier series	Properties of continuous Time Fourier Series	T-3, Chap-4
16	Evaluate the Fourier series representation of aDT signals	Fourier Series representation of DT Signals	T-3, Chap-4
17	understand the properties of DTFS	Properties of DTFS.	T-3, Chap-4
18	understand the properties of DTFS	Properties of DTFS.	T-3, Chap-9
19	Analyze the representation of aperiodic signal and its continuous time Fourier transform	Representation of Aperiodic Signal: The continuous Time Fourier Transform	T-3, Chap-9
20	Evaluate the FT for periodic signals	The FT for periodic Signals	T-3, Chap-9
21	Analyze the properties of CTFT	Properties of the CTFT	T-3, Chap-9
22	Analyze the properties of CTFT	Properties of the CTFT	T-3, Chap-2
23	Evaluate the convolution property	The convolution property	T-3, Chap-2
24	Evaluate the multiplication property	The multiplication Property	T-3, Chap-9
25	Analyze the characteristics of the system for linear constant coefficient differential equations	Systems characterized by Linear constant coefficient Differential equations.	T-3, Chap-9

26	Understand the sampling theorem and analyze representation of a continuous time signals by its samples	Sampling theorem Representation of a continuous Time signals by its samples	T-3, Chap-7
27	Evaluate the reconstruction of the signal from its samples	Reconstruction of a signal from its samples	T-3, Chap-7
28	Analyze the effect of under sampling on the reconstruction of the signal	The effect of Under sampling	T-3, Chap-7
29	Understand the technique of Laplace transform	Introduction, The Laplace transform	T-3, Chap-10
30	Analyze the region convergence properties	properties of the region of convergence	T-3, Chap-10
31	Evaluate the properties of the Laplace Transform	properties of the Laplace Transform	T-3, Chap-10
32	Understand the technique of inverse Laplace transform	Inverse of the Laplace transform	T-3, Chap-10
33	Analyze LTI system and characterization of LTI systems using Laplace Transform	The unilateral Laplace Transforms Analysis and characterization of LTI systems using Laplace Transform	T-3, Chap-10
34	Applies Laplace transformations in solving LTI systems	The unilateral Laplace Transforms Analysis and characterization of LTI systems using Laplace Transform	T-3, Chap-10
35	Evaluate the Z-transform	The Z- transform, Introduction, The Z-transform	T-3, Chap-10
36	Analyze the properties of region of convergence	properties of the region of convergence	T-3, Chap-10
37	Analyze the properties of Z-Transform	properties of the Z – transform	T-3, Chap-10
38	Evaluate inverse Z-transform	Inverse of the Z – transform	T-3, Chap-10
39	Analysis and characterization of LTI systems using Z- Transform	The unilateral Z – transform, Analysis and characterization of LTI systems using Z – transforms.	T-3, Chap-10

40	understand the representation of the aperiodic signals	Introduction, Representation of Aperiodic signals	T-3, Chap-5
41	Evaluate the Fourier transform for periodic signals	The Fourier transform for periodic signals	T-3, Chap-5
42	Evaluate the properties of the DTFT	properties of the DTFT	T-3, Chap-5
43	Evaluate the convolution properties	The convolution property	T-3, Chap-5
44	Evaluate the multiplication property	The multiplication property	T-3, Chap-5
45	Analyze the characteristic of a duality system for a liner constant coefficient difference equations	Duality, systems characterized by linear constant –coefficient – Difference equations.	T-3, Chap-5

6.Self learning material:

S.no	Unit	Topic	Source
1	I	Elementary Signals	T1
2	II	Fourier Series representation of DT Signals	T1
3	II	Properties of DTFS.	T1
4	IV	properties of the region of convergence	T1
5	IV	properties of the Z – transform	T1
6	V	properties of the DTFT	T2
7	V	systems characterized by linear constant –coefficient– Difference equations.	T2

7.Evaluation Scheme:

Component	Duration (minutes)	% Weightage	Marks	Date & Time	Venue
Test-1	50 Min	7.5	10	13-08-2010 9.30 to 10.20 A.M	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Test-2	50 Min	7.5	10	17-09-2010 9.30 to 10.20 A.M	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Assignement submission		3.75	5	Continuous	
Assignment Test	50 Min	3.75	5	29-10-2010 9.00 to 10.20 A.M	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Quiz	30 Min	3.75	5	29-10-2010 9.00 to 10.20 A.M	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Regular Lab Evaluation	Continuous	12.5	50		
Comprehensive Lab Exam	3 Hrs	10	40		
Comprehensive Exam	3 Hrs	45	60		
Attendance for Theory & Tutorial		3.75	5	Continuous	
Attendance for Lab		2.5	10	Continuous	

8. Chamber consultation hour: Informed in the class in first week.

9. Notices: All notices regarding the course will be put in E-learning website.

Course Coordinator