Sir Padampat Singhania University, Udaipur

Department of Electronics & Communication Engineering

COURSE PLAN (SPRING 2009-2010)

Name of the Course Teacher : R.N. Mishra
Subject : Signals and Systems
Branch: ECE Semester: IV Year: II
Course Code: EC 206 L-T-P-C: 3-1-0-4 ***w.e.f. 29.12.2009***

Sr. No.	Topic	Contact Hours (Lectures)
1.	Basic concept of Signals and Systems, One dimensional, two dimensional and multi-dimensional signals, Continuous and discrete-time signals, Signal and System interaction.	1
2.	Analysis and design problems, Classification of signal: Continuous, Discrete, Deterministic and Random signals, Energy and Power Signals, Even and Odd Signals, Periodic and a periodic Signal.	1
3.	Representation of any arbitrary signal as even and odd components, symmetry of signal, signal transformation, time and amplitude scaling for continuous and discrete-time signals, advancing and delaying a signal.	1
4.	Exponential signal representation and its analysis in continuous-time domain, Singularity function: step and impulse functions, Limiting definition of step and impulse functions.	1
5.	Shifting and Sampling property, Discrete-time elementary signals: step sequence, sample sequences, relationship between $\delta(t)$ and $\delta(n)$. Analysis of discrete-time exponential signal.	1
6.	Periodicity of discrete-time complex exponential signal, Systems: Continuous, discrete and hybrid systems, Interconnection of systems: series/ tandem connection, parallel connection, series-parallel connection and feedback connection.	1

7.	Memory less and memory systems, SISO and MIMO systems, System classification: Static and dynamic systems, time variant and invariant systems, linear and non-linear systems, stable and unstable systems, invertible and non-invertible systems.	1
8.	Linear time invariant system, decomposition of any arbitrary signal as sum of weighted impulse, convolution integral and convolution sum, computation of convolution operation.	1
9.	Different methods of convolution computation: Analytic method, Graphical method and Tabular method.	1
10.	Properties of convolution operation: Commutative, associative and distributive properties.	1
11.	Stability of LTI system: Continuous and discrete, Causality of LTI system: Continuous and discrete, Step response of LTI system, Inverse system and decomposition.	1
12.	FIR system, IIR system, Non-recursive and Recursive systems, Representation of LTI system using constant coefficient differential equation.	1
13.	Differential equation representation for LTI systems: RLC and RC circuits described by constant coefficient differential equation- natural response, forced response and complete response, Solution of differential equations describing LTI systems.	1
14.	Solution of difference equations describing discrete-time LTI systems- Natural response, force response and complete response, Solution of difference equations describing discrete-time LTI systems.	1
15.	Correlation: Autocorrelation and Cross-correlation, Computation of autocorrelation and cross-correlation sequences.	1
16.	Systems described by constant coefficients differential equations, Properties of linearity and introduction to Fourier series, Euler's hypothesis and periodicity, Trigonometric and exponential form of Fourier series.	1

17.	Existence and uniqueness of Fourier series, Fourier series representation for elementary signals, Amplitude and Phase spectrums, Convergence of Fourier series and truncated Fourier series.	1
18.	Minimization of error and energy condition, Dirichlet condition, Michelson experimentation, Gibbs phenomenon.	1
19.	Introduction to Fourier transform, Existence and convergence of Fourier transform, Dirichlet conditions, Fourier transform of elementary signals.	1
20.	Fourier Transform and duality property, Fourier transform of periodic signals, properties of Fourier transform: Linearity, symmetry, delay in time, frequency shifting, time scaling and convolution properties.	1
21.	Additional properties: Integral property, Parseval theorem, duality property, modulation property, sampling, aliasing effect, Nyquist rate and choice of sampling frequency.	1
22.	Frequency response and LTI system, Properties of Fourier series: Linearity, time shifting, time reversal, conjugation and conjugation symmetry, time differentiation and convolution in time.	1
23.	Multiplication property, Parseval's relation, Discrete-time Fourier series, Finding Fourier series and Fourier coefficients for discrete-time signals.	1
24.	Discrete-time Fourier transform, Existence of discrete-time Fourier transform, absolute sum ability and energy condition, Finding discrete-time Fourier transform for elementary signals.	1
25.	Fourier transform for discrete-time exponential function, Fourier transform pair in continuous and discrete-time domain and their relationship, Fourier transform of discrete-time periodic signal.	1
26	Properties of DTFT: Periodicity, Linearity, Time shifting, Frequency shifting, convolution property, differentiation in time and scaling property.	1
27	Additional properties: Differencing in time, summing property, Parseval theorem, modulation property, system function and application of DTFT in LTI system analysis.	1

28	Generalization of Fourier transform and introduction to Laplace transform, relationship between Laplace and Fourier transform, convergence issues and ROC, Laplace transform for elementary signals.	1
29	ROC and properties of ROC: left sided sequences, right sided sequences, finite duration sequences, types of ROC, Inverse Laplace transform.	1
30	Properties of Laplace transform: Linearity, Time shifting, shifting in s-domain, differentiation in time domain, differentiation in frequency domain.	1
31	Convolution in time domain and importance of convolution property, integration in time, integration in s-domain, summary of Laplace transform of signal and their ROCs.	1
32	Laplace transform of elementary signals, Application of Laplace transform for LTI system analysis, stability and causality analysis of LTI system from the ROCs.	1
33	System interconnection: Series, parallel and feedback connection of LTI systems, Unilateral Laplace transform, comparison between unilateral and bi-lateral Laplace transform.	1
34	Properties of unilateral Laplace transform: Differentiation in time, initial value theorem, final value theorem, solution of problems.	1
35	Introduction to Z-transform, relationship between DTFT and Z-transform, ROCs and convergence issues, Z-transform of elementary signals.	1
36	Z-transform of exponential sequence: Left sided sequences, right sided sequences, two sided sequences, finite duration sequences, pole-zero diagram and ROC, stability issue and location of poles in the Z-plane.	1
37	Properties of ROC. Inverse Z-transform- Contour integral method, long division method and partial fraction method.	1
38	Finding direct and inverse Z-transform of discrete-time signals of analysis of LTI systems.	1
39	Properties of Z-transform: Wide hearted operation and linearity property and resultant ROC. Time shifting and frequency shifting properties, Time reversal, convolution and differentiation properties.	1

40	Initial value theorem, interpolation and decimation, summation, Application of Z-transform in analysis of discrete-time system, stability and causality analysis from the ROC of Z-transform.	1
41	Unilateral Z-transform, Comparison between unilateral and bilateral Z-transform with examples.	1
42	Concept of random variable, Probability density and distribution function, function of random variable.	1
43	Random process, auto and cross correlation, random process through LTI system.	1
Total		43

Texts:

1. Signals and Systems by Oppenheim, Willsky and Nawab, Pearson Publication.
2. Signals and Systems by Simon Haykin and Veen, Wiley India Pvt. Ltd.

References:

1. Signals, Systems and Transform by Philips and Parr, Pearson Publication.
2. Signals and Systems by HP Hsu, McGraw-Hill Company
3. Signals and Systems by Stuller, Thomson publication
4. Signals and Systems by J.S Chitode, Technical Publication
5. Video Cassette for the course “Signals and Systems” by Prof. Datta Ray of IIT, Delhi.
6. Signals and Systems by J.B Gurung, PHI Publication

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