Syllabus 3rd sem

31 August 2023 09:18

Course Code	Course Name	Course Structure	
EAEPC05	Signal and Systems	3-1-0	L-T-P

COURSE OUTCOME (CO):

CO1: To understand the concept of signals and systems and their classifications.
CO2: To understand the concept of convolution and its applications.
CO3: To analyze the spectral characteristics of continuous-time and discrete-time periodic and aperiodic *signals* using Fourier analysis.
CO4: To analyze continuous-time LTI systems in the time domain and s-domain
CO5: To analyze discrete-time LTI systems in the time domain and z-domain

COURSE CONTENT:

Unit-I:

Concept definition & classification of signals– Continuous time (CT) and Discrete Time (DT) signals, Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Properties of unit impulse in continuous and discrete domain, Concept of orthogonality, Transformation of independent variables, Classification of systems & their properties, Waveform synthesis.

Unit-II:

Convolution integrals and its properties, Properties of LTI System, impulse response, step response, convolution sum and its properties, graphical method.

Unit-III:

Fourier series representation of continuous time and discrete time signals and their properties. Magnitude and Phase spectrum of signals.

Continuous time Fourier Transform and its properties, Discrete time Fourier Transform and its properties. Magnitude and Phase representations of frequency response of LTI systems. Introduction to LP/BP/HP/All Pass systems. Relationship between discrete time signals and Sampled continuous time low pass signals.

Unit-IV:

Laplace Transform and its properties, concept of ROC and its properties. Inverse-Laplace transform. Unilateral Laplace transform and its applications. Computation of impulse response, total response (zero state and zero input response) & transfer function using Laplace transform. Stability and causality of continuous-time LTI Systems.

Unit-V:

Z-Transform and its properties, ROC and its properties, Inverse Z-transform; Power series expansion and partial fraction expansion. Relationship between Z-transform, Fourier transform and Laplace transform. Stability and causality of discrete-time LTI System. Unilateral Z transform and its applications. Computation of impulse response, total response (Zero state and Zero input response) & Transfer function using Z-Transform.

Course Code	Course Name	Course Structure	
EAEPC06	Probability Theory and Random Process	L-T-P	3-1-0

COURSE OUTCOME (CO):

CO1: To understand the probability theory and random variables for the analysis of random phenomena.
CO2: To characterize probability models and function of random variables based on single & multiples random variables.
CO3: To evaluate and apply moments & characteristic functions and understand the concept of inequalities.
CO4: To understand the concept of random processes and determine covariance and spectral density of stationary random processes.
CO5: To understand representation of low pass and band pass noise models.

COURSE CONTENT:

Unit-I:
Probability Theory: Introduction to Random Variables, PDF, CDF. Continuous/Discrete/Mixed type random variables. Normal, Exponential, chi-square, Rayleigh, Nakagami-m, uniform distributions, etc. Bernoulli, Binomial, Poisson distributions. Expectation, Variance, Moments, Characteristic functions.

Unit-II:
Joint Random variables and random vectors. Independent, uncorrelated random variables. Joint Expectation, co-variance, Joint Moments, joint characteristic functions, conditional distributions, conditional expectation. Multidimensional Gaussian law

Unit-III:
Functions of random variables of the type Y=g(X), Z=g(X,Y) and two functions of two random variables, Inequalities of Chebyshev and Schwartz. Chernoff Bounds.

Unit-IV:
Random processes. First-order stationary processes, second order and wide sense stationary process, Nth order and strict sense stationary process, Time averages and ergodicity, Mean ergodic process, Auto correlation function and its properties, Cross-correlation function and its properties, Covariance functions and their properties, discrete time processes and sequences,

Unit-V:
Power density spectrum and its properties, Linear systems with random inputs. Random signal response, Auto correlation functions of the response, Cross correlation functions of input and output system, Power density spectrum of the response, Spectral representation. Wiener- Khinchine theorem. Gaussian process, White process, Response of LTI systems to White Noise

Course Code	Course Name	Course Structure		Pre-requisites
EAEPC08	Digital Circuits and Systems	L-T-P	3-0-2	EEE

COURSE OUTCOMES

After the completion of the course, the students should be able to:

CO1: Get familiarized with number systems, codes, logic gates and Boolean algebra
CO 2: Understand the properties and operation of contemporary logic families.
CO 3: Design and implement basic combinational and sequential circuits.
CO 4: Understand the motivation and need for modelling and synthesis using Hardware Description Languages.
CO 5: Understand system design processes using programmable logic devices, operation of building blocks of a digital computer system.

UNIT-1: Logic functions and operation of logic families

Digital design representations (e.g., truth table, equations, schematic, etc.), Different codes and their properties (e.g., Gray, BCD, 1-Hot etc.). Signed and unsigned Number representation and conversion. Binary addition and subtraction (unsigned and one's and two's complement). Boolean equations and terminology (SOP, POS, minterm, maxterm), Logic implementations of equations (2-level, AND/OR, NAND/NOR, etc.). Characteristics of TTL and CMOS logic families (i.e., logic thresholds, delay, Noise margin, fan-in and fan-out, power dissipation), TTL to CMOS and CMOS to TTL interfacing.

UNIT-2: Elements of Combination logic

Overview of Boolean algebra, Simplification of logic functions using (i) K-map up to 5 variables with don't care conditions (ii) Tabulation (Quine-McCluskey) method. Combinational logic design: half and full adder, half and full subtractor. Multiplexers, Encoders, Decoders, Priority encoders, Comparators, Magnitude comparator, Demultiplexer. Code converters: BCD to Seven Segment Display (SSD), Binary to SSD. Introduction to a PROM and its use for implementing arbitrary logic functions.

UNIT-3: Elements of sequential logic.

SR Latch, D Latch, Master-Slave operation of a latch. Latch versus flip-flop, Flip-Flops (D, SR, JK, and T), Registers, Shift registers (SISO, SIPO, PISO), Linear feedback shift registers. Ripple and synchronous counters. PWM generator. Binary multiplier. Synchronous and asynchronous sequential circuits. Mealy and Moore sequential models. Design of Finite state machine using state table, state diagram, state assignment (binary, Gray, one-hot), next state and output equations. Example FSM implementations.

UNIT-4: Hardware Description Language

Modern digital design methods. Motivation and need for hardware description language. Introduction to VHDL and important terminology. VHDL Library and packages. Entities, architecture and configurations. Signals and data types. Operators and processes. VHDL code examples of all combinational and sequential circuits from unit-2 and unit-3 including FSM.

Modern digital design methods. Motivation and need for hardware description language. Introduction to VHDL and important terminology. VHDL Library and packages. Entities, architecture and configurations. Signals and data types. Operators and processes. VHDL code examples of all combinational and sequential circuits from unit-2 and unit-3 including FSM. **UNIT-5: Digital System Design and Programmable Logic Devices** Digital system design using FSMD approach. Design of illustrative systems using VHDL, such as game of dual-dice, rock-paper-scissor, reaction timer, period counter etc. Elements of CPU - RAM and DRAM; ALU; control logic using FSM and microprogram control approach; register file. Introduction to programmable logic devices - PAL/PLA, GAL, CPLD and FPGA. Introduction to JTAG.

Course **Code**	Course Name	Course Structure	
EAEPC07	**Microelectronic Circuits and applications**	L-T-P	3-0-2
COURSE OUTCOME (CO): After completing the course, the students should be able to: CO-1: Describe the Small signal high frequency models of BJT and MOS transistors use them in the high and low frequency analysis of single-stage amplifiers CO-2: Analyze differential and multi-stage amplifiers involving BJTs and MOSFETs CO-3: Understand and describe the linear and nonlinear applications of op-amps and OTAs including filters, linear impedances etc. CO-4: Understand and elaborate the importance of negative feedback amplifier topologies and their characteristic features along with relevant analysis of also the positive feedback in the realization of sinusoidal oscillators CO-5: Understand and describe power amplifiers and their realization involving power BJTs and Power MOSFETs.			
Unit No	Topics		
Unit 1	Review of large signal (DC) and small signal (AC) models of BJTs and MOSFETs. High frequency models of BJT and MOSFET, Biasing techniques in integrated circuit (IC) amplifiers, High frequency response of CS and CE amplifiers with passive and active loads, high frequency response of CG and CB amplifiers with active loads, CS and CE amplifiers with source de-generation, Source follower and emitter follower, low frequency response of CE, CB, CC, CE with RE, CS, CG, CD and CS with Rs amplifiers.		
Unit 2	Multi-stage amplifiers using MOSFETs and BJTs, Cascode amplifier, Darlington pair, Differential and multi-stage amplifiers: MOS differential pair and its DC and small signal operation. BJT/MOS differential pair, ideal and Non-ideal characteristics of differential amplifiers, Differential amplifiers with active load.		
Unit 3	Block diagram representation of OP-Amp and OTA: Linear and non-linear applications of Operational amplifiers: amplifiers (inverting, non-inverting, differential), mathematical operations (summer/subtractor, integrator, differentiator), 1st-order and second-order filters, impedance realizations, linear applications of OTA.		
Unit 4	Non-linear applications of Op- Amp: multiplier, divider, log/antilog, squarer/square-rooter etc, exponential, Rectangular, Triangular, sawtooth waveform generators, 555 timer IC and their applications, Phase-locked loop and its application, function generator ICs		
Unit 5	Feedback amplifiers and Sinusoidal oscillators: General feedback structure, Properties of negative feedback, Four basic feedback topologies, Loop gain, Stability problem, Basic principle of sinusoidal oscillators, RC phase shift and Wien		
	and power amplifiers: Class A, Class B, Class AB output amplifier stages, Class C amplifiers, Power BJTs, MOS power transistor, Discrete and IC power amplifiers		

Course No.	Title of the course:	Course Structure:	Pre-requisite
EAMTC04	**Mathematics for Machine Learning**	3L-1T-0P	None

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EAMTC04	**Mathematics for Machine Learning**	**3L-1T-0P**	**None**

COURSE OUTCOMES:

1. To understand the Vector space and Linear Transformation.
2. To know concept of Inner product spaces and norms.
3. To know concept of Matrix decomposition.
4. To know concept of Calculus and Vector Analysis.
5. To know concept of Optimization.

COURSE CONTENT:

UNIT-I

Linear Algebra: Vector space, Subspaces, linearly dependent and independent vectors, Basis and dimension of a vector space, Linear Transformation with examples, Rank-Nullity theorem, Matrix representation of Linear Transformation.

UNIT-II

Matrix Theory: Inner Product Space, Norms, Orthogonal Component and Projection, , Gram-Schmidt process; Properties of Eigen value and Eigen vector, Orthogonal Matrix, Symmetric & Skew Symmetric Matrix, Quadratic form, Positive Definite Matrix, Positive Semi Definite Matrix.

UNIT-III

Matrix Decomposition: Singular Value Decomposition, Pseudo-Inverse, Low Rank Approximation, Polar decomposition, Right Polar Decomposition, Left Polar Decomposition.

UNIT-IV

Vector Calculus: Directional derivatives, Hessian, Convex set & function and its properties; Scalar and vector functions, Gradient, Divergence and Curl, Directional Derivatives, Line Integrals, Surface Integrals, Volume Integrals. Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem (without proof).

UNIT-V

Optimization: Optimality conditions for unconstrained optimization, Constrained optimization problem, KKT optimality conditions, Convex and Quadratic Programming Problem, Classification problems, Support vector machine, Steepest descent method.

SUGGESTED BOOKS:

1. MATHEMATICS FOR MACHINE LEARNING, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong.
2. Mathematics for Machine Learning, Garrett Thomas.