Electrical Circuits

Subject Code: **L/T/P/C**
3/1/0/4
Int: 30, Ext: 70, Total: 100

UNIT-I
Network Elements : Resistance, Capacitance, Self inductance, Mutual inductance, Dot rule, Coefficient of coupling, Analysis of multi-winding coupled (series and parallel) circuits; Natural response and forced response.
DC Transients: Inductor, Capacitor, Source free RL, RC and RLC response, Evaluation of initial conditions, application of Unit-step function to RL, RC and RLC circuits, Concepts of Natural, Forced and Complete response.

UNIT-II
Differential Equations: Linear constant coefficient differential equations; time domain analysis of simple RL, RC and RLC circuits, Solution of network equations using Laplace transform

UNIT-III
Sinusoidal steady state analysis: Characteristics of sinusoids, Forced Response to Sinusoidal Functions, The Complex Forcing Functions, The Phasor, Phasor Relationship for R,L and C, Impedance and Admittance, Phasor Diagram.

UNIT-IV
Network Topology: Network terminology - Graph of a network - Incidence and reduced incidence matrices – Trees –Cutsets - Fundamental cutsets - Cutset matrix – Tiesets.
Network Functions: Poles and zeros of network functions, Network functions for the one- and two-ports, Restrictions on pole and zero locations for driving point functions and transfer functions.

UNIT-V
Two Port Network Parameters : Open circuit impedance (Z) parameters - short circuit admittance(Y) parameters - transmission (ABCD) parameters and inverse transmission parameters -Hybrid (h) parameters and inverse hybrid parameters - Conversion between parameters -interconnection of two-port networks. Lattice networks, Image parameters.

Teaching methodologies:
- Power Point presentations
- Tutorial Sheets
- Assignments
- Lab experiments with Pspice Software

Text Books:
1. William H. Hayt Jr. and Jack E. Kemmerly, 'Engineering Circuit Analysis', 6th Edition, McGraw Hill 2008.
2. Vanvalkenburg M.E, 'Network Analysis', PHI,3rd Edition, 2007.
3.Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.,2008.
Reference:
1. Edminister J. ' Circuit Theory', Schaum's outline Series, TMH 1998
2. Valkenberg V., Network Synthesis. 2008

ELECTRONIC CIRCUIT ANALYSIS

Subject Code: **L/T/P/C**
3/1/0/4
Int: 30, Ext: 70, Total: 100

UNIT- I

Feedback Amplifiers : Classification of Amplifiers, Feedback concept, Transfer Gain with feedback, General characteristics of negative feedback amplifiers, Effect of Feedback on input and output Resistances, Method of Analysis of Feedback Amplifiers, Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components and their analysis

UNIT-II

Oscillators: Condition for oscillations. RC-phase shift oscillators with Transistor and FET with necessary derivation for frequency of oscillation, Hartley and Colpitts oscillators, Wein bridge oscillator, Crystal oscillators, Frequency and amplitude stability of oscillators, Negative Resistance in Oscillator

UNIT III

Multistage Amplifier : Cascading Transistor Amplifiers, Choice of Transistor configuration in Cascade amplifier, High input Resistance Transistor Circuits – Darlington pair, Cascode amplifier, Frequency response and analysis of RC Coupling, Direct coupling and Transformer coupling, Difference amplifier Two Stage RC Coupled JFET amplifiers (in Common Source (CS) configuration).

Unit IV

Power Amplifiers: Class A large signal Amplifiers, Second harmonic Distortions, Higher order harmonic Distortion, Transformer Coupled Audio power amplifier, Efficiency, Push-pull amplifiers, Class B Amplifiers, Class AB operation, Efficiency of Class B Amplifier, Complementary Symmetry push pull amplifier, stability and Heat sink.

Unit V

Tuned Amplifiers : Introduction, Q-Factor, Small Signal Tuned Amplifier – Capacitance single tuned amplifier, Double Tuned Amplifiers, Effect of Cascading Single tuned amplifiers on Band width, Effect of Cascading Double tuned amplifiers on Band width, Staggered tuned amplifiers, Stability of tuned amplifiers.

Text Books:

1. Electronic Devices and Circuits - Salivahanan, N.Suressh Kumar, A. Vallavaraj, TATA McGraw Hill, Second Edition, 2011.

2. John D Ryder, “Electronic Fundamentals and Applications: Integrated and Discrete Systems” 5nd Edition, PHI, 2003. (UNIT- V for Tuned Amplifiers)

Reference Books:

1. Robert L Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10th Edition, 2009, Pearson India.
2. Donald L. Schilling and Charles Belove, “Electronic Circuits - Discrete and Integrated”, 3rd Edition, 2002, TMH.
3. Electronic Circuit Analysis and Design – Donald A. Neaman, Mc Graw Hill.

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Subject Code: **L/T/P/C**
2/1/0/3
Int: 30, Ext: 70, Total: 100

UNIT -I
PROBABILITY & RANDOM VARIABLES:
Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Baye's Theorem, Independent Events, Random Variable, Functions of random variable, Discrete and Continuous, Mixed Random Variable, Distribution and Density functions, Binomial, Poisson, Uniform, Gaussian Distribution.

UNIT -II
OPERATIONS ON SINGLE VARIABLE – EXPECTATIONS:
Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable. Vector Random Variables

UNIT-III
OPERATIONS ON & MULTIPLE RANDOM– EXPECTATIONS:
Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density - Point Conditioning, Conditional Distribution and Density -Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions.

UNIT -IV
RANDOM PROCESSES -TEMPORAL CHARACTERISTICS:
The Random process, classification, deterministic and nondeterministic processes, distribution and density Functions, stationarity and statistical independence, first-order stationary processes, second-order and wide-sense stationarity, autocorrelation function and its properties, cross-correlation function and its properties, covariance functions, Gaussian random processes, random signal response of linear systems, autocorrelation and cross-correlation functions of input and output.

UNIT -V
RANDOM PROCESSES-SPECTRAL CHARACTERISTICS AND NOISE:
The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.
MODELLING OF NOISE:
Introduction to noise, types and sources of noises, noise in communication system, Arbitrary Noise Sources, Resistive and Thermal Noise Source, Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks.
Text Books :

1.Probability, Random Variables and Stochastic Processes - Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

2.Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4^{th} Edition, 2001

REFERENCES :

1.Probabilistic Methods of Signals and System Analysis-George R. Cooper and Clare D. McGillem, oxford, 3rd Edition, 2007.
2. R.P. Singh and S.D. Sapre, “Communication Systems Analog & Digital”, 1995,TMH.

Web Resources:

1. http://walrandpc.eecs.berkeley.edu/126notes.pdf
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT- %20Guwahati/probability_rp/index.htm

SIGNALS AND SYSTEMS

Subject Code: **L/T/P/C**
3/1/0/4
Int: 30, Ext: 70, Total: 100

Unit 1: Introduction to Continuous-time Signals and Systems: Typical signals (impulse, step, ramp, sinusoid, exponential, signum, sinc); Time-domain scaling, shifting, and folding; Continuous-time signal characteristics (periodicity, frequency, deterministic, random, symmetry, energy and power); Properties of continuous-time systems (linearity, time invariance, causality and stability). Analogy between vectors and signals; Orthogonal signal space; Signal approximation using orthogonal functions; Mean squared error; Closed set of orthogonal functions; Orthogonality in complex functions.

Unit 2: Fourier Series, Fourier Transform, and Laplace Transform: Representation of continuous-time periodic signals by Fourier series; Dirichlet's conditions; Properties of Fourier series, Parseval's theorem; Trigonometric and Exponential Fourier series; Complex Fourier spectrum; Fourier transform via Fourier series; Fourier transform of periodic and aperiodic signals; Convergence of Fourier transform; Properties of Fourier transforms, Parseval's theorem; Fourier transforms involving impulse function and Signum function; Introduction to Hilbert Transform; Definition of two- & one-sided Laplace transform, Region of convergence (ROC); Relation between LT and FT.

Unit 3: Signal Transmission through Linear Systems: Continuous-time Linear Time-Invariant system, Representation by differential equations, Transforms and State-variables; Impulse response, Convolution; Transfer function, frequency response; Ideal vs. realizable LPF, HPF and BPF characteristics; Signal bandwidth, system bandwidth, rise-time, gain-bandwidth; Distortion; Causality and Paley-Wiener criterion for physical realization.

Unit 4: Sampling & Discrete-time Signals: Sampling theorem – Graphical and analytical proof for Band Limited Signals; Impulse-train sampling; Natural and Flat-top Sampling; Reconstruction of signal from its samples; Under-sampling and Aliasing; Band-pass Sampling Theorem; DT signal characteristics (periodicity, frequency, deterministic, random, symmetry, energy and power).

Unit 5: Z-Transform: Discrete time signal representation using complex exponential and sinusoidal components; z-Transform of a discrete sequence; Region of convergence of z-Transform, Constraints on ROC for various classes of signals; Relationship between z-Transform and DTFT (Fourier spectrum); Transfer function of a LTI system (No difference equations); Properties of z-Transform; Inverse z-Transform by Partial Fractions (simple poles) only.

Text Books

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Second Edition, PHI Learning, New Delhi, 2007.
2. B. P. Lathi, Signals, Systems and Communications-B.S. Publications, 2003.

Reference Books

1. M. J. Roberts, "Signals and Systems", Second Edition, Tata-McGraw Hill, 2012.
2. Simon Haykin and Barry Van Veen, "Signals and Systems", Edition, John Wiley and Sons, 2002.

DIGITAL ELECTRONICS

Subject Code: **L/T/P/C**
3/1/0/4
Int: 30, Ext: 70, Total: 100

UNIT -I

Boolean algebra & Logic Gates: Digital systems, Number- Base Conversions, Signed Binary Numbers, Binary Codes, Axiomatic Definition of Boolean Algebra, Basic Theorems, Boolean Functions, Canonical and standard Forms.

Logic Gates: Digital Logic Gates, Integrated Circuits, Gate-level Minimization; The Map Method, Four-Variable Map, Five-Variable Map, Product-of-Sums Simplification, Don't-care Conditions, NAND and NOR Implementation, Exclusive-OR Function.

UNIT -II

Combinational logic: Introduction to Combinational circuits, Analysis Procedure, Design Procedure, Code-conversion, Binary Adder-Subtractor, Carry Propagation, Half Subtractor, Full Subtractor, Binary Subtractor, Decimal Adder, BCD adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, and Multiplexers with design examples.

Introduction to VHDL, VHDL for combinational circuits.

UNIT-III

Sequential Logic: Flip-Flops, Triggering of Flip Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Fundamentals of Asynchronous Sequential Logic: Introduction, Analysis procedure, Circuits with Latches, Design Procedure.

VHDL for sequential circuits

UNIT -IV

Registers and Counters: Registers with parallel load, Shift registers; Serial Transfer, Serial Addition, Universal Shift Register, Ripple Counters; Binary Ripple Counter, BCD Ripple Counter, Synchronous Counters; Binary Counter, Up-Down Counter, BCD Counter, Binary Counter with Parallel Load, Counter with Unused States, Ring Counter, Johnson Counter.

VHDL for Registers and Counters.

UNIT-V

Memory and Programmable Logic: Random-Access Memory, Write and Read Operations, Timing waveform, Types of Memories, Memory Decoding; Internal Construction, Coincident Decoding, Address Multiplexing, Read-Only Memory; Combinational Circuit Implementation, Types of ROMs, Combinational PLDs, Programmable Logic Array, Programmable Array Logic.

Text books:

1. M Morris Mano and Michael D. Ciletti, Digital Design, Fourth Education, Pearson 5th ed2013.
2. Charles H.Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengaue learning 6th edition, 2013
3. J. Bhaskar, " A VHDL Primer", 3rd edition, Addison Wesley, 2007

Reference books:

1. Zvi Kohavi and Niraj K Jha, Switching and Finite Automata Theory, 3rd Edition, TMH,2010.
2. Frederick J. Hill and Gerald R Peterson, Introduction to Switching theory and logic design, 3rd Edition, John Wiley and sons, 1981.

Signals Systems Lab

Subject Code: **L/T/P/C**
0/0/2/2
Int: 25, Ext: 50, Total: 75

List of experiments

1. Basic operations on matrices.
2. Generation of various signals and sequences (periodic and aperiodic), such as unit impulse, unit step, square, saw tooth, Triangular, sinusoidal, ramp, sinc.
3. Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.
4. Finding the even and odd parts of signal/sequence and real and imaginary parts of signal.
5. Convolution between signals and sequences.
6. Auto correlation and cross correlation between signals and sequences.
7. Verification of linearity and time invariance properties of a given continuous/discrete system.
8. Computation of unit sample, unit step and sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties.
9. Gibbs phenomenon.
10. Finding the Fourier transform of a given signal and plotting its magnitude and phase spectrum.
11. Waveform synthesis using Laplace transforms.
12. Finding the Laplace and Inverse Laplace transform of a given signal.
13. Finding the Z and Inverse Z transform of a given signal.
14. Locating the zeros and poles and plotting the pole-zero maps in S-plane and Z-plane for the given transfer function.
15. Generation of Gaussian noise (Real and Complex), computation of its mean, mean squared, Value and its Skew, Kurtosis, and PSD, Probability distribution Function.
16. Sampling Theorem Verification.
17. Removal of noise by Autocorrelation / Cross Correlation.
18. Extraction of periodic signal masked by noise using Correlation

Note: A minimum of 12 (Twelve) experiments have to be performed and recorded by the candidate to attain eligibility for Practical Examination.

Digital Electronics Lab

Subject Code: **L/T/P/C**
0/0/2/2
Int: 25, Ext: 50, Total: 75

List of Experiments

1. DESIGN AND SIMULATION OF COMBINATIONAL CIRCUITS USING VHDL

Experiment 1: Realization of Gates

Experiment 2: Half adder, Full adder

Experiment 3: Magnitude comparator

Experiment 4: Decoder

Experiment 5: Multiplexer

Experiment 6: Demultiplexer

Experiment 7: Binary to Grey Code Converter

Experiment 8: Parity Checker

2. DESIGN AND SIMULATION OF SEQUENTIAL CIRCUITS USING VHDL

Experiment 9: D and T Flip-Flops

Experiment 10: Frequency Divider

Experiment 11: Left Shift Register

Experiment 12: Serial to Parallel Shift Register

Experiment 13: Binary Counter

Experiment 14: Asynchronous BCD Up Counter

Experiment 15: Synchronous Down Counter

Note: A minimum of 12 (Twelve) experiments have to be performed and recorded by the candidate to attain eligibility for Practical Examination.

Electronic Circuit Analysis Lab

Subject Code: **L/T/P/C**
0/0/2/2
Int: 25, Ext: 50, Total: 75

I. List of Experiments:

1) Design and Simulate the Common Base Amplifier
2) Design and Simulate the Common Emitter Amplifier
3) Design and Simulate the Common Source Amplifier
4) Design and Simulate RC Coupled Amplifier
5) Design and Simulate the Cascade Amplifier
6) Design and Simulate Cascode Amplifier
7) Design and Simulate Darlington Pair
8) Design and Simulate RC Phase Shift Oscillator using Transistor
9) Design and Simulate Wien Bridge Oscillator using Transistor
10) Design and Simulate Hartely and Colpitt's Oscillator
11) Design and Simulate Class A power Amplifier
12) Design and Simulate Single Tuned Voltage Amplifier