R23

MALINENI LAKSHMAIAH WOMEN'S ENGINEERING COLLEGE
(AUTONOMOUS)
Guntur - 522 017, Andhra Pradesh.
DEPARTMENT OF ELECTRONICS ENGINEERING (VLSI Design & Tech.)

I Year – I Sem		L	T	P	C
		3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to ECE, EE(VLSI D&T),CSE-AI&ML, CSE-DS, AI&DS)

Course Objectives

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field. Course Outcomes: After the completion of the course students will be able to

CO1. Describe fundamental laws, operating principles of motors/generators, MC/MI instruments (L2)

CO2. Demonstrate the working of electrical machines, measuring instruments and power generation stations. (L2)

CO3. Apply mathematical tools and fundamental concepts to derive various equations related to electrical circuits and machines. (L3)

CO4. Calculate electrical load and electricity bill of residential and commercial buildings. (L4)

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition

2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition

2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020

3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017

4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053

2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

• To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.

2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.

3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

End examination pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.

ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.

iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

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I Year – I Sem		L	T	P	C
		0	0	3	1.5

ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
(Common to ECE, EE(VLSI D&T),CSE-AI&ML, CSE-DS, AI&DS)

Course Objectives

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

After competition of this course, the student will be able to

CO1. Measure voltage, current and power in an electrical circuit. (L3)

CO2. Measure of Resistance using Wheat stone bridge (L4)

CO3. Discover critical field resistance and critical speed of DC shunt generators. (L4)

CO4. Investigate the effect of reactive power and power factor in electrical loads. (L5)

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
    - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
    - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
    - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
    - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments.

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition

2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify & testing of various electronic components.

CO2: Understand the usage of electronic measuring instruments.

CO3: Plot and discuss the characteristics of various electron devices.

CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.

2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.

3. Implementation of half wave and full wave rectifiers

4. Plot Input & Output characteristics of BJT in CE and CB configurations

5. Frequency response of CE amplifier.

6. Simulation of RC coupled amplifier with the design supplied

7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.

8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

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NETWORK ANALYSIS

Course category:	**Engineering Sciences (ES)**	Credits:	**3**
Course Type:	**Theory**	L-T-P	**3-0-0**
Year:	**I**	CIE Marks:	**30**
Sem.:	**II**	SEE Marks:	**70**
		Total Marks:	**100**

COURSE OBJECTIVES:

- To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
- To impart knowledge on applying appropriate theorem for electrical circuit analysis
- To explain transient behavior of circuits in time and frequency domains
- To teach concepts of resonance
- To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of this course students will demonstrate the ability to		
CO1	Understand basic electrical circuits with nodal and mesh analysis.	**L2**
CO2	Analyse the circuit using network simplification theorems.	**L4**
CO3	Find Transient response and Steady state response of a network.	**L3**
CO4	Analyse electrical networks in the Laplace domain.	**L4**
CO5	Compute the parameters of a two-port network.	**L3**

Note: *L1-Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

UNIT-I

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.

Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependent sources also.

UNIT-II

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non- homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.

Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT-III

Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

UNIT-IV

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.

Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT-V

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.

Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.

Textbooks:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

Reference Books:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7 th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education

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NETWORK ANALYSIS AND SIMULATION LAB

Course category:	**Engineering Sciences (ES)**	Credits:	**1.5**
Course Type:	**Practicals**	L-T-P	**0-0-3**
Year:	**I**	CIE Marks:	**30**
Sem.:	**II**	SEE Marks:	**70**
		Total Marks:	**100**

COURSE OBJECTIVES:

- To gain hands on experience in verifying Kirchoff's laws and network theorems
- To analyze transient behavior of circuits
- To study resonance characteristics
- To determine 2-port network parameters

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of this course students will demonstrate the ability to		
CO1	Verify Kirchoff's laws and network theorems.	**L3**
CO2	Measure time constants of RL & RC circuits.	**L3**
CO3	Analyze behavior of RLC circuit for different cases.	**L4**
CO4	Design resonant circuit for given specifications.	**L3**
CO5	Characterize and model the network in terms of all network parameters.	**L3**

Note: *L1-Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

COURSE CONTENTS

The following experiments need to be performed using both Hardware and simulation Software.

The experiments need to be simulated using software and the same need to be verified using the hardware.

1. Study of components of a circuit and Verification of KCL and KVL.
2. Verification of mesh and nodal analysis for AC circuits
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits
4. Verification of maximum power transfer theorem for AC circuits
5. Verification of Tellegen's theorem for two networks of the same topology.
6. Study of DC transients in RL, RC and RLC circuits
7. To study frequency response of various 1st order RL & RC networks
8. To study the transient and steady state response of a 2nd order circuit by varying its various parameters and studying their effects on responses
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.
10. Determination of open circuit (Z) and short circuit (Y) parameters
11. Determination of hybrid (H) and transmission (ABCD) parameters
12. To measure two port parameters of a twin-T network and study its frequency response.

Hardware Requirements:

Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components

Software requirements:

Multisim/ Pspice/Equivalent simulation software tool, Computer Systems with required specifications

References:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.

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II Year – I Sem		L	T	P	C
		3	0	0	3

PROBABILITY THEORY AND STOCHASTIC PROCESS
(Common to EE(VDT), ECE)

COURSE OBJECTIVES

- This gives basic understanding of random variables and operations that can be performed on them.
- To know the Spectral and temporal characteristics of Random Process.
- To Learn about Noise sources and its representation for understanding its characteristics.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Mathematically model the random phenomena and solve simple probabilistic problems.	**L3**
CO2	Perform operations on single and multiple Random variables.	**L4**
CO3	Determine the Spectral and temporal characteristics of Random Signals.	**L2**
CO4	Analyse the LTI systems with random inputs and to Construct and analyse the mathematical modelling of noise sources.	**L4**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

PROBABILITY THEORY AND STOCHASTIC PROCESS

UNIT I - PROBABILITY & RANDOM VARIABLE :

Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events, Random Variable-Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.**(CO1)**

UNIT II - OPERATIONS ON SINGLE & MULTIPLE RANDOM VARIABLES – EXPECTATIONS :

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic and Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable. Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Statistical Independence. Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions. Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties. **(CO2)**

UNIT III - RANDOM PROCESSES – TEMPORAL CHARACTERISTICS :

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. **(CO3)**

UNIT IV - RANDOM PROCESSES – SPECTRAL CHARACTERISTICS :

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. **(CO3)**

UNIT V - LINEAR SYSTEM WITH RANDOM INPUTS:

Random Signal Response of Linear Systems: System Response, Convolution, Mean and Mean Squared Value of System Response, Auto Correlation of Response and Cross Correlation functions of Input and Output. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output. **(CO4)**

NOISE SOURCES:

Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties. **(CO4)**

TEXTBOOKS:

1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles, 4 th Ed, TMH, 2001.
2. Taub and Schilling - Principles of Communication systems, TMH, 2008

REFERENCE BOOKS:

1. Bruce Hajck - Random Processes for Engineers, Cambridge unipress, 2015
2. Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes, 4th Ed., PHI, 2002.
3. B.P. Lathi - Signals, Systems & Communications, B.S. Publications, 2003.
4. S.P Eugene Xavier -Statistical Theory of Communication, New Age Publications,2003.

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II Year – I Sem		L	T	P	C
		3	0	0	3
SIGNALS AND SYSTEMS (Common to EE(VDT), ECE)					

COURSE OBJECTIVES

- To study about signals and systems.
- To analyze the spectral characteristics of signal using Fourier series and Fourier transforms.
- To understand the characteristics of systems.
- To introduce the concept of sampling process
- To know various transform techniques to analyze the signals and systems.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Differentiate the various classifications of signals and systems	**L3**
CO2	Analyze the frequency domain representation of signals using Fourier concepts	**L4**
CO3	Classify the systems based on their properties and determine the response of LTI Systems.	**L3**
CO4	Apply sampling theorem to convert continuous-time signals to discrete time signal and reconstruct the original signal from samples.	**L3**
CO5	Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).	**L4**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

SIGNALS AND SYSTEMS

UNIT- I – INTRODUCTION :

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals ,Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Related problems.**(CO1)**

UNIT–II - FOURIER SERIES AND FOURIER TRANSFORM :

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms ,Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform, Related problems. **(CO2)**

UNIT-III - ANALYSIS OF LINEAR SYSTEMS :

Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant(LTV)system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth ,system bandwidth ,Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time. **(CO3)**

UNIT–IV -SAMPLING THEOREM :

Graphical and analytical proof or Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling–Aliasing, Introduction to Band Pass sampling, Related problems. **(CO4)**

UNIT–V - LAPLACE TRANSFORMS:

Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. **(CO5)**

Z–TRANSFORMS :

Concept of Z-Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z transforms. **(CO5)**

Textbooks:

1.Signals, Systems&Communications-B.P.Lathi,BSPublications,2003.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab,PHI,2ndEdn,1997
3. Signals&Systems-SimonHaykinandVanVeen,Wiley,2ndEdition,2007

Reference Books:

1. Principles of Linear Systems and Signals–BP Lathi, Oxford University Press,2015
2. Signals and Systems–TK Rawat, Oxford University press,2011.

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		3	0	0	3
ELECTRONIC DEVICES AND CIRCUITS (Common to EE(VDT), ECE)					

COURSE OBJECTIVES

- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- To learn and understand the application of diodes as Clippers and Clampers, rectifiers with their operation and characteristics with and without filters are discussed.
- Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
- To learn and understand the purpose of transistor biasing and its significance.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers and compare different configurations.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.	**L2**
CO2	Analyze the construction, working principle of Semiconductor Devices and Diode Circuits	**L4**
CO3	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions	**L2**
CO4	Apply small signal low frequency transistor amplifier circuits using BJT and FET in different configurations	**L3**

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ELECTRONIC DEVICES AND CIRCUITS

UNIT-I:

JunctionDiodeCharacteristics: EnergybanddiagramofPNjunctionDiode,Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in p-n junction Diode, Diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance. **(Text book: 1)(CO1)**

DiodeCircuits: TheDiodeasacircuitelement,TheLoadLineconcept,ThePiecewise Linear Diode model, Clipping (limiting) circuits, Clipping at Two Independent Levels, Peak Detector, Clamping circuits, Comparators, Sampling Gate, Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, Filters, Inductor filter, Capacitor filter, π section Filter **(Text book: 1, 2)(CO2)**

UNIT-II:

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, Varactor Diode, LED, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR, Construction, operation and V-I characteristics. **(Text book: 1) (CO2)**

UNIT-III:

Transistor Characteristics: Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values. **(Text book: 1) (CO2)**

Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S''),Bias compensation, Thermal runaway, Thermal stability. **(Text book: 1)(CO3)**

UNIT-IV: Small Signal Low Frequency Transistor Amplifier Models

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers. **(Text book: 1, 2)(CO4)**

UNIT-V: FET: FET types, JFET operation, characteristics, small signal model of JFET. **(Text book: 1)(CO2)**

MOSFET: MOSFET Structure, Operation of MOSFET: operation in triode region, operation in saturation region, MOSFET as a variable resistor, derivation of V-I characteristics of MOSFET, Channel length modulation, MOS trans conductance, MOS device models: MOS small signal model, PMOS Transistor, CMOS Technology, Comparison of Bipolar and MOS devices. **(Text book: 3)(CO2)**

CMOS Amplifiers: General Considerations, Common Source Stage, Common Gate Stage, Source Follower, comparison of FET amplifiers.

(Text book: 3)(CO4)

Text Books:

1. Millman's Electronic Devices and Circuits J.Millman, C.C.Halkias and Satyabrata Jit, Mc-Graw Hill Education, 4th edition, 2015.
2. Millman's Integrated Electronics-J.Millman,C.Halkias, and Ch. D. Parikh, Mc-Graw Hill Education, 2nd Edition, 2009.
3. Fundamentals of Microelectronics-BehzadRazavi, Wiley,3rdedition,2021.

References:

1. Basic Electronics Principles and Applications, ChinmoySaha, ArindamHalder, Debarati Ganguly, Cambridge University Press.
2. Electronics devices & circuit theory RobertL.Boylestad and LouiNashelsky, Pearson, 11thedition,2015.
3. Electronic Devices and Circuits - David A.Bell, Oxford University Press, 5th edition,2008.
4. Electronic Devices and Circuits- S. Salivahanan, N. Suresh Kumar, Mc-Graw Hill, 5th edition, 2022.

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		L	T	P	C
II Year – I Sem		**3**	**0**	**0**	**3**

SWITCHING THEORYAND LOGIC DESIGN

(Common to EE(VDT), ECE)

COURSE OBJECTIVES:

- To solve a typical number base conversion and analyze new error coding techniques
- Theorems and functions of Boolean algebra and behavior of logic gates
- To optimize logic gates for digital circuits using various techniques.
- Boolean function simplification using Karnaugh maps and Quine-Mccluskey methods
- To understand concepts of combinational circuits
- To develop advanced sequential circuits

COURSE OUTCOMES:

	Course Outcomes (COs)	Bloom's Taxonomy Knowledge Level (KL)
	At the end of this course students will demonstrate the ability to	
CO1	Classify different number systems and apply to generate various codes.	**L2**
CO2	Use the concept of Boolean algebra in minimization of switching functions.	**L3**
CO3	Design different types of combinational logic circuits.	**L4**
CO4	Apply knowledge of flip-flops in designing of Registers and counters.	**L4**
CO5	The operation and design methodology for synchronous sequential circuits and algorithmic state machines.	**L3**

Note: *L1-Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

UNIT-I

REVIEW OF NUMBER SYSTEMS & CODES:

Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members, 4 bit codes, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity. (**CO1**)

BOOLEAN THEOREMS AND LOGIC OPERATIONS:

Boolean theorems, principle of complementation & duality, De-Morgan theorems, Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX- NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486. (**CO2**)

UNIT-II

MINIMIZATION TECHNIQUES:

Minimization and realization of switching functions using Boolean theorems, K-Map (up to 5 variables) and tabular method (Quine-mccluskey method) with only four variables and single function (**CO2**)

COMBINATIONAL LOGIC CIRCUITS DESIGN:

Design of Half adder, full adder, half Subtractor, full Subtractor, applications of full adders; 4-bit adder-Subtractor circuit, BCD adder circuit, Excess 3 adder circuit, Design code converts using Karnaugh method and draws the complete circuit diagrams. (**CO3)**

UNIT-III

COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI:

Design of encoder, decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits. Realization of Boolean functions using decoders and multiplexers, Design of Priority encoder, 4-bit digital comparator, Study the relevant ICs pin diagrams and their functions 74138, 7485,74154. (**CO3**)

INTRODUCTION OF PLD's:

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table. (**CO3**)

UNIT-IV

Classification of sequential circuits (synchronous and asynchronous), operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip- flop, T flip-flop, D flip-flop with reset and clear terminals, Master Slave Flip flop, Conversion from one flip-flop to another flip- flop, Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, shift register, Classification of shift registers, universal shift register, Study the following relevant ICs and their relevant functions 7474, 7475,7476,7490,7493 (**CO4**)

UNIT-V

Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa, Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping) (**CO5)**

TEXT BOOKS:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rdEdition, Cambridge University Press, 2009
2. Digital Design by M. Morris Mano, Michael D Ciletti, 4th Edition PHI publication,2008
3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012.

REFERENCES:

1. Fundamentals of Logic Design by Charles H. Roth Jr,Jaico Publishers,2006
2. Digital electronics by R S Sedha.S.Chand & company limited, 2010

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II Year – I Sem		L	T	P	C
		0	0	3	1.5

ELECTRONIC DEVICES AND CIRCUITS LAB
(Common to EE(VDT), ECE)

COURSE OBJECTIVES:

- The aim of this laboratory is to give practical exposure to students on various electronic components, semiconductor devices and electronics instruments which facilitate to design basic electronic circuits and analyze their characteristics. The laboratory caters to the courses on basic electronic devices and analog electronic circuits enabling the students to verify the theoretical concepts of electronic devices and circuits.

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Understand the usage of electronic measuring instruments.	**L2**
CO2	Analyze the V-I characteristics of different electronic devices such as diodes, transistors.	**L4**
CO3	Verify the applications of diodes and transistors	**L3**
CO4	Examine the amplification characteristics of CE,CC,CS Configurations	**L4**

Note:- *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

List of Experiments:

1. CRO Operation and its Measurements
2. Clipper circuit using diode
3. Clamping circuit using diode
4. Transistor as a switch
5. BJT Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
6. FET Characteristics (CS Configuration)
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
7. SCR Characteristics
8. UJT Characteristics
9. Transistor Biasing
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

Note: Any TEN of the listed experiments are to be conducted.

Equipment required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multi-meters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

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		L	T	P	C
II Year – I Sem		0	0	3	1.5

Switching Theory and Logic Design Lab

(Common to EE(VDT), ECE)

COURSE OBJECTIVES:

- To gain the design of digital circuits and fundamental concepts used in the design of digital systems
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Test the operation of different logic gates using relevant IC's.	**L4**
CO2	Examine the operation of different combinational logic circuits.	**L3**
CO3	Apply the concept of Boolean algebra or k-maps to reduce and Construct logic circuit for given function.	**L3**
CO4	Analyse the Truth tables of different Flip-Flops.	**L4**
CO5	Design of registers using sequential logic circuits and Design of Synchronous & Asynchronous counters using Flip-Flops.	**L4**

***Note:**- L1-Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

List of Experiments:

1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
2. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
3. Verification of truth table of 8*1 Multiplexer
4. 4 variable logic function verification using 8 to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional table of JK Master Slave Flip–Flop
7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output.
8. Design a four-bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the Output
    (b) Construct 7 Segment Display Circuit Using Decoder and7 Segment LED and test it.

Additional Experiments:

1. Design BCD Adder Circuit and Test the Same using Relevant IC
2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.
3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Language

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II Year – I Sem		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Hands-on PCB Design and Assembly
(for EE(VDT))

COURSE OBJECTIVES

This course is designed to:

1. Impart hands-on skills in PCB design using EDA tools.
2. Familiarize students with design rules and fabrication processes.
3. Enable students to assemble and test their own PCBs.
4. Encourage problem-solving through real-time hardware implementation.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Understand the fundamentals of PCB design, layers, and fabrication technologies	**L2**
CO2	Design circuit schematics using EDA tools and create PCB layouts	**L3**
CO3	Generate fabrication-ready files including Gerber and BoM.	**L3**
CO4	Perform manual soldering of through-hole and SMD components	**L4**
CO5	Test and troubleshoot simple hardware prototypes using PCBs.	**L5**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

Hands-on PCB Design and Assembly

1. **Introduction to PCBs**: Types, materials, layers, applications, design flow overview
2. **Schematic Design**: Component libraries, netlist creation, multi-sheet circuit design
3. **PCB Layout Design**: Board outline, placement, routing, ground/power planes, DRC
4. **Design for Manufacturability (DFM)**: PCB rules, trace width, spacing, via types, EMI/EMC
5. **Fabrication Process**: Gerber generation, NC drill, silkscreen, solder mask, vendor files
6. **Assembly Techniques**: Soldering tools, through-hole and SMD, flux, reflow oven basics
7. **Testing and Troubleshooting**: Multimeter tests, continuity check, visual inspections
8. **Mini Project**: Design, layout, fabrication, assembly, and testing of a small circuit

List of Experiments:

1. Design and simulate an LED blinking circuit using 555 timer.
2. Create PCB layout for a voltage regulator using LM7805.
3. Generate Gerber files and validate against industry standards.
4. Fabricate and solder a single-layer PCB.
5. Test an op-amp-based amplifier on a fabricated PCB.
6. Assemble and test a basic temperature sensor circuit (e.g., LM35/DHT11).
7. Debug common PCB design and soldering issues (cold solder, shorts).
8. Complete and demonstrate a mini project (e.g., IR-based counter, burglar alarm).

Software & Hardware Requirements

- **EDA Tools**: KiCad, EasyEDA, Eagle, Proteus
- **Tools Required**: Soldering station, PCB etching kit, multimeter, components, breadboards

References:

1. **R.S. Khandpur**, *Printed Circuit Boards: Design, Fabrication, Assembly and Testing*, Tata McGraw Hill.
2. **Simon Monk**, *Make Your Own PCBs with Eagle*, McGraw-Hill.
3. Online tutorials and documentation on KiCad.org, EasyEDA.com.
4. Application notes from manufacturers (TI, Analog Devices, etc.).

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II Year – II Sem		L	T	P	C
		3	0	0	3
PYTHON PROGRAMMING (Only for EE(VDT))					

COURSE OBJECTIVES

The Objectives of Python Programming are

- To learn about Python Programming language syntax, semantics, and the runtime environment.
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & function
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Develop essential programming skills in computer programming concepts like data types, containers	**L3**
CO2	Apply the basics of programming in the Python language	**L3**
CO3	Solve coding tasks related conditional execution, loops	**L4**
CO4	Solve coding tasks related to the fundamental notions and techniques used in object oriented programming	**L4**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

PYTHON PROGRAMMING

UNIT I: Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops. **(CO1,CO2)**

UNIT II : Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files. **(CO1, CO2, CO3)**

UNIT III: List and Dictionaries: Lists, Defining Simple Functions, Dictionaries Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function.Modules: Modules, Standard Modules, Packages. **(CO1,CO2)**

UNIT IV: File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism. **(CO4)**

UNIT V: Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources. Programming: Introduction to Programming Concepts with Scratch **(CO4)**

TEXTBOOKS:

1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

2) Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

REFERENCE BOOKS:

1) Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.

2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

E-Resources:

https://www.tutorialspoint.com/python3/python_tutorial.pdf

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II Year – II Sem		L	T	P	C
		3	0	0	3
BASIC VLSI DESIGN (for EE(VDT))					

COURSE OBJECTIVES

- To learn the MOS Process Technology
- To understand the operation of MOS devices
- Understand and learn the characteristics of CMOS circuit construction.
- Describe the general steps required for processing of CMOS integrated circuits.
- To impart in-depth knowledge about analog and digital CMOS circuits.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Demonstrate a clear understanding of CMOS fabrication flow and technology scaling	**L2**
CO2	Apply the design Rules and draw layout of a given logic circuit	**L3**
CO3	Design MOSFET based logic circuit	**L4**
CO4	Design and analyze CMOS logic circuits for the implementation of combinational logic using both static and dynamic techniques	**L4**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

BASIC VLSI DESIGN

UNIT-I: MOS TRANSISTORS AND FABRICATION TECHNOLOGY

Introduction, The Structure of MOS Transistors, The MOS Capacitor, The MOS Transistor representation, Modes of Operation of MOS Transistors, Basic Fabrication Processes, Wafer Fabrication, Oxidation, Mask Generation, Photolithography, Diffusion, Deposition, NMOS and PMOS Fabrication, CMOS Fabrication : n-Well Process, p-Well Process, Twin-Tub Process

UNIT-II: BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS

Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS Transistor Trans-conductance gm, output conductance, Figure of Merit, Body Effect, nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter

UNIT-III: MOS AND BI-CMOS CIRCUIT DESIGN PROCESSES

MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/Bi-CMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams- Translation to Mask Form.

UNIT-IV:

SCALING OF MOS CIRCUITS

Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density, MOS Transistors as a Switch , Gate logic.

UNIT-V:

CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN

Static CMOS Design: Complementary CMOS, Rationed Logic, Pseudo nMOS logic.

Dynamic CMOS Design: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Choosing a Logic Style, Gate Design in the Ultra Deep-Submicron Era, Clocked CMOS register. Cross coupled NAND and NOR, SR Master Slave register, Storage mechanism, Pipelining

TEXTBOOKS

1. Essentials of VLSI Circuits and Systems – Kamran Eshraghian, Douglas and A.Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.

2. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata McGraw- Hill Education, 2003.

3. Digital Integrated Circuits, Jan M.Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd Edition, 2016.

REFERENCES

1. “Introduction to VLSI Circuits and Systems”, John P.Uyemura, John Wiley&Sons, reprint 2009.

2. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology, 3’rd Edition, David Hodges.

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II Year – II Sem		L	T	P	C
		3	0	0	3
ELECTRONIC CIRCUIT ANALYSIS (Common to EE(VDT), ECE)					

COURSE OBJECTIVES

Course Objectives:

The main objectives of this course are:

- To learn hybrid π parameters at high frequency and compare with low frequency parameters.
- Learn and understand the purpose of cascading of single stage amplifiers and derive the overall voltage gain.
- Analyze the effect of negative feedback on amplifier characteristics and derive the characteristics.
- Learn and understand the basic principle of oscillator circuits and perform the analysis of different oscillator circuits.
- Compare and analyze different Power amplifiers like Class A, Class B, Class C, Class AB and other types of amplifiers.
- Analyze different types of tuned amplifier circuits.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.	**L4**
CO2	Design and analysis of multistage amplifiers using BJT and FET and Differential amplifier using BJT.	**L4**

CO3	Analyze the effect of feedback on the performance of feedback amplifiers and oscillators.	**L4**
CO4	Know the classification of the power and tuned amplifiers and their analysis with performance comparison	**L2**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

ELECTRONIC CIRCUIT ANALYSIS

UNIT-I Small Signal High Frequency Transistor Amplifier models:

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductance, Hybrid π capacitances, validity of hybrid π model, determination of high- frequency parameters in terms of low-frequency parameters , CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of common Source and common drain Amplifier circuits at high frequencies**. (CO1)**

UNIT-II

Multistage Amplifiers: Classification of amplifiers, methods of coupling**, C**ascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Differential amplifier using BJT. **(CO2)**

UNIT-III

Feedback Amplifiers: Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers. **(CO3)**

Unit-IV

Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC phase shift and Wien bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators**. (CO3)**

UNIT-V

Power Amplifiers: Classification of amplifiers(A to H), Class A power Amplifiers, Class B Push-pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks. **(CO4)**

Tuned Amplifiers: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, staggered tuned amplifiers. **(CO4)**

Text Books:

1. IntegratedElectronics-J.MillmanandC.C.Halkias,Tata McGraw-Hill,1972.
2. Electronic Devices and Circuits Theory–RobertL.Boylestad and Louis Nashelsky, Pearson/PrenticeHall, TenthEdition, 2009.
3. Electronic Devices and Integrated Circuits – B.P. Singh, Rekha, Pearson publications,2006

References:

1. Electronic Circuit Analysis and Design Donald A.Neaman, McGraw Hill, 2010.
2. MicroelectronicCircuits-SedraA.S.andK.C.Smith, OxfordUniversity Press, Sixth Edition, 2011.
3. Electronic Circuit Analysis B.V.Rao, K.R.Rajeswari, P.C.R.Pantulu, K.B.R.Murthy, Pearson Publications.

II Year – II Sem		L	T	P	C
		3	0	0	3

DIGITAL IC DESIGN
(for EE(VDT))

COURSE OBJECTIVES

- Introduction of digital logic families and inter facing concepts for digital design is considered.
- VHDL fundamentals were discussed to modeling the digital system design blocks.
- Design and implementation of combinational and sequential digital logic circuits is explained.

Course Outcomes: After the completion of the course students will be able to

COURSE OUTCOMES

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Describe the structure and functional characteristics of commercially available digital integrated circuits.	**L2**
CO2	Explain the syntax and semantics of IEEE Standard 1076 Hardware Description Language (VHDL).	**L2**
CO3	Construct models for complex digital systems using behavioral, structural, and rapid system prototyping levels of abstraction in VHDL.	**L6**
CO4	Analyze and design combinational and sequential digital circuits using VHDL.	**L4,L6**

Note: *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Course Contents

DIGITAL IC DESIGN

UNIT-I Introduction to VHDL:

Design flow, program structure, levels of abstraction, Elements of VHDL: Data types, data objects, operators and identifiers. Packages, Libraries and Bindings, Subprograms, Data Flow Modeling, Structural Modeling, VHDL Programming using structural and data flow modeling.**(CO1, CO2)**

UNIT-II Behavioral Modeling:

Process statement, variable assignment statement, signal assignment statement, wait statement , if statement, case statement ,null statement, loop statement, exit statement, next statement ,assertion statement, more on signal assignment statement ,Inertial Delay Model, Transport Delay Model ,Creating Signal Waveforms, Signal Drivers , Other Sequential Statements , Multiple Processes. Logic Synthesis, inside a logic Synthesizer **(CO3)**

UNIT-III Combinational Logic Design:

Parallel binary adder, carry look ahead adder, Decoders, Priority Encoder, Multiplexers and de-multiplexers and their use in combinational logic design, ALU, digital comparators, parity generators, code converters. Design considerations of the above combinational logic circuits with relevant Digital ICs, modeling of above ICs using VHDL **(CO4)**

UNIT-IV Sequential Logic Design:

SSI Latches and Flip-Flops, Registers, shift registers, Universal Shift Registers, ripple counters, synchronous counters, Modulus Counters, Ring Counter, Johnson Counter, hazards in sequential circuits. Design considerations of the above combinational logic circuits with relevant Digital ICs, modeling of above ICs using VHDL **(CO4.CO5)**

UNIT-V Combinational and Sequential MOS Logic Circuits:
Introduction, MOS logic circuits with depletion nMOS loads: two- input NOR gate, transient analysis of NOR gate, two-input NAND gate, transient analysis of NAND gate, CMOS logic circuits: CMOS NOR2 gate, CMOS NAND2 gate, complex logic circuits, complex CMOS logic gates, AOI and OAI gates, Pseudo-nMOS gates, CMOS full-adder circuit, pass-transistor logic.

SR and D latch circuits, flip-flop circuits: SR, D, JK and T flip flops, master-slave flip-flop, CMOS D-latch and Edge- triggered flip-flop **(CO4.CO5)**

TEXTBOOKS

1. Modern Digital Electronics–R.P.Jain-Fourth Edition–Tata McGraw Hill Education Private Limited, 2010.

2. CMOS Digital Integrated Circuits-Analysis and Design–Sung-MoKang & Yusuf Leblebici-Tata McGraw Hill Publishing Company Limited, 2006.

3. VHDL/Verilog Primer - J.Bhasker, Pearson Education/PHI, 3rd Edition.

REFERENCES

1. Digital Design Principles & Practices-John F.Wakerly, PHI/Pearson Education Asia, 3rd Edition, 2005.

2. Fundamentals of Digital Logic with VHDL Design - Stephen Brown, Zvonko Vranesic, McGraw Hill, 3rd Edition.

II Year – II Sem		L	T	P	C
		0	0	3	1.5
DIGITAL IC DESIGN LAB (for EE(VDT))					

COURSE OBJECTIVES:

- To enable students to understand and implement the internal logical design of basic combinational and sequential digital circuits.
- To develop skills in writing HDL (VHDL/Verilog) code using different modeling styles (behavioral, dataflow, and structural) for digital systems.
- To train students in simulation, synthesis, and verification of digital circuits using industry-standard EDA tools and FPGA hardware
- To enable students to design complex digital systems like ALU, FIFO, and MAC, enhancing problem-solving and hardware implementation skills.

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Implement basic combinational and sequential circuits using VHDL/Verilog HDL.	**L3**
CO2	Analyze and verify the functionality of digital designs using simulation tools and FPGA hardware.	**L4**
CO3	Apply different modeling techniques (behavioral, structural, dataflow) for designing digital circuits.	**L3**
CO4	Design, synthesize, and implement complex digital modules such as ALU, FIFO, and MAC on FPGA platforms.	**L5**

***Note:**- L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Note: The students are required to design and draw the internal logical structure of the following Digital Integrated Circuits and to develop VHDL/Verilog HDL Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer.

List of Experiments :(Minimum of Ten Experiments has to be performed)

1. Realization of Logic Gates
2. Design of Full Adder using 3 modeling systems
3. 3 to 8 Decoder -74138
4. 8 to 3 Encoder (with and without parity)
5. 8 x 1 Multiplexer-74151 and 2x 4 De-multiplexer-74155
6. 4- Bit comparator-7485
7. D Flip-Flop-7474
8. Decade counter -7490
9. Shift registers-7495
10. 8-bit serial in-parallel out and parallel in-serial out
11. Universal Shift Register
12. MAC (Multiplier & Accumulator)
13. ALU Design.

Equipment/Software required:

1. Xilinx Vivado/ISE software / Equivalent Industry Standard Software
2. Xilinx Hardware / Equivalent hardware
3. Personal computer system with necessary software to run the programs and

   Implement.

MALINENI LAKSHMAIAH WOMEN'S ENGINEERING COLLEGE (AUTONOMOUS)

Guntur - 522 017, Andhra Pradesh.

DEPARTMENT OF ELECTRONICS ENGINEERING (VLSI Design & Tech.)

II Year – II Sem		L	T	P	C
		0	0	3	1.5
ELECTRONIC CIRCUIT ANALYSIS LAB **(Common to EE(VDT), ECE)**					

COURSE OBJECTIVES:

The main objective is to introduce different types of AMPLIFIERS and study their characteristics. With this knowledge students will be able to do mini-projects with the help of diodes and transistors.

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Analyze the frequency response of single, multistage amplifiers and feedback amplifiers	**L4**
CO2	Design and simulate RC and LC Oscillators for the given specifications	**L4**
CO3	Compare the Efficiency of Class A and Class B Amplifiers and calculate the resonant frequency of Tuned amplifiers.	**L3**
CO4	Design multistage amplifiers, feedback amplifiers, power amplifiers, tuned amplifiers using MULTISIM Simulation tool.	**L4**

***Note:**- L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

Note: The students are required to design the circuit and perform the simulation using Multisim/Equivalent Industrial Standard Licensed simulation software tool**.** Further they are required to verify the result using necessary hardware equipment

List of Experiments:

1. Determination of Ft of a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift/Wien Bridge Oscillator
5. Hartley/Colpitt's Oscillator
6. Two Stage RC Coupled Amplifier
7. Darlington Pair Amplifier
8. Bootstrapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

Note: Any TEN of the listed experiments are to be conducted.

Equipment required: Software:

i. Multisim/Equivalent Industrial Standard Licensed simulation software tool.
ii. Computer Systems with required specifications

Equipment required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multi-meters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

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II Year – II Sem		L	T	P	C
		0	0	3	1.5
PYTHON PROGRAMMING LAB (for EE(VDT))					

COURSE OBJECTIVES:

The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

COURSE OUTCOMES:

Course Outcomes (COs)		Bloom's Taxonomy Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Develop essential programming skills by understanding computer programming concepts such as data types and containers	**L2, L3**
CO2	Apply the foundational constructs of Python programming including syntax, expressions, and modularity	**L3**
CO3	Solve coding problems using control structures such as conditional execution and loops	**L3,L4**
CO4	Solve programming tasks using object-oriented principles like class design, inheritance, and operator overloading	**L4**

Note:- *L1- Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create*

LIST OF EXPERIMENTS:

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3) Write a program that uses a for loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5) Use a for loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

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*
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****
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6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7) Write a program that asks the user for two numbers and prints Close if the numbers are within .001 of each other and Not close otherwise.
8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters abcde and ABCDE the program should print out AaBbCcDdEe.
10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.
11) In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
12) Write a program that generates a list of 20 random numbers between 1 and 100.
(a) Print the list.
(b) Print the average of the elements in the list.
(c) Print the largest and smallest values in the list.
(d) Print the second largest and second smallest entries in the list

(e) Print how many even numbers are in the list.
13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.
15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].
16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.
17) Write a function called sum_digits that is given an integer num and returns the sum of the digits of num.
18) Write a function called first_diff that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
19) Write a function called number_of_factors that takes an integer and returns how many factors the number has.
20) Write a function called is_sorted that is given a list and returns True if the list is sorted and False otherwise.
21) Write a function called root that is given a number x and an integer n and returns x1/n. In the function definition, set the default value of n to 2.
22) Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
23) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
(a) Do this using the sort method. (b) Do this without using the sort method.
24) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
26) Write a program that reads a list of temperatures from a file called temps.txt, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.
27) Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method get_price that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for

orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called make_purchase that receives the number of items to be bought and decreases amount by that much.

28) Write a class called Time whose only field is a time in seconds. It should have a method called convert_to_minutes that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called convert_to_hours that returns a string of hours, minutes, and seconds formatted analogously to the previous method.

29) Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.

30) Write a Python class to implement pow(x, n).

31) Write a Python class to reverse a string word by word.

32) Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.

33) Write a program to demonstrate Try/except/else.

34) Write a program to demonstrate try/finally and with/as.