ANDHRA LOYOLA INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

AR24 B.TECH SECOND YEAR

COURSE STRUCTURE & SYLLABUS

ANDHRA LOYOLA INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.–II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS	Probability theory and stochastic process	3	0	0	3
2	HSMC	Universal Human Values– Understanding Harmony and Ethical Human Conduct	2	1	0	3
3	Engineering Science	Signals and Systems	3	0	0	3
4	Professional Core	Electronic Devices and Circuits	3	0	0	3
5	Professional Core	Switching Theory and Logic Design	3	0	0	3
6	Professional Core	Electronic Devices and Circuits Lab	0	0	3	1.5
7	Professional Core	Switching Theory and Logic Design Lab	0	0	3	1.5
8	Skill Enhancement Course	Data Structures using Python	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			**16**	**2**	**08**	**20**

B.Tech. II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course-I	Managerial Economics and Financial Analysis	2	0	0	2
2	Engineering Science	Linear Control Systems	3	0	0	3
3	Professional Core	Electromagnetic Waves and Transmission Lines	3	0	0	3
4	Professional Core	Electronic Circuit Analysis	3	0	0	3
5	Professional Core	Analog Communications	3	0	0	3
6	Professional Core	Signals and Systems Lab	0	0	3	1.5
7	Professional Core	Electronic Circuit Analysis lab	0	0	3	1.5
8	Skill Enhancement course	Soft Skills	0	1	2	2
9	Engineering Science	Design Thinking &Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation						

II Year-I Semester

L	T	P	C
3	0	0	3

PROBABILITY THEORYAND STOCHASTIC PROCESS

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 the Basic concepts of Information theory Noise sources and its representation for understanding its characteristics

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.

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, Conditional Distribution and Density–Point Conditioning, Conditional Distribution and Density– Interval conditioning, 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, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables

UNIT-III Random Processes–Temporal Characteristics:
The Random Process Concept, Classification of Processes, Deterministic and Non deterministic 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. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

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. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

UNIT-V Noise Sources & Information Theory:

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. Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade -off between bandwidth and SNR.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. BruceHajck-Random Processes for Engineers, Cambridge unipress,2015
2. Athanasios Papoulis and S.Unnikrishna Pillai-Probability, RandomVariables and Stochastic
3. Processes,4thEd.,PHI,2002.
4. B.P.Lathi- Signals, Systems & Communications, B.S.Publications,2003.
5. S.PEugene Xavier- Statistical Theory of Communication, New Age Publications, 2003.

Course Outcomes:

- Perform operations on single and multiple Random variables.
- Determine the Spectral and temporal characteristics of Random Signals.
- Characterize LTI systems driven by stationary random process by using ACFs and PSDs.
- Understand the concepts of Noise and Information theory in Communication systems

L	T	P	C
3	0	0	3

II Year-I Semester

SIGNALS AND SYSTEMS

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.

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.

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.

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.

UNIT–IV: CORRELATION: Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

SAMPLINGTHEOREM: 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.

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. Laplace transform of certain signals using waveform synthesis.

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.

TEXT BOOKS:

1. Signals,Systems & Communications-B.P.Lathi,BSPublications,2003.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn,1997
3. Signals & Systems- Simon Haykin and Van Veen, Wiley, 2nd Edition,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

Course Outcomes:
At the end of this course the student will able to:
- Differentiate the various classifications of signals and systems
- Analyze the frequency domain representation of signals using Fourier concepts
- Classify the systems based on their properties and determine the response of LTI Systems.
- Know the sampling process and various types of sampling techniques.
- Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).

II Year-I Semester

L	T	P	C
3	0	0	3

ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:

- To learn and understand the basic concepts of semiconductor physics.
- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- To learn and understand the application of diodes as 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.

UNIT-I: Review of Semiconductor Physics: Mobility and Conductivity, Intrinsic and extrinsic semiconductors**,** Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors. **(Text book: 1)**

Junction Diode Characteristics: energy band diagram of PN junction Diode, 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)**

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)**

DiodeCircuits: The Diode as a circuit element, The Load-Line concept, The Piecewise 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, Inductorfilter, Capacitorfilter, π-section Filter, comparison of various filter circuits in terms of ripple factors. **(Text book: 1, 2)**

UNIT-III: Transistor Characteristics: Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, 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)**

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)**

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)**

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

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)**

CMOS amplifiers: General Considerations, Common Source Stage,Common Gate Stage, Source Follower, comparison of FET amplifiers. **(Text book: 3)**

TextBooks:

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. BasicElectronics-PriciplesandApplications,ChinmoySaha,ArindamHalder,Debarati Ganguly, Cambridge University Press.
2. Electronicsdevices&circuittheory-RobertL.BoylestadandLouiNashelsky, 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.

Course Outcomes:

- Apply the basic concepts of semiconductor physics.
- Understand the formation of p-n junction and how it can be used as a p-njunction as diode in different modes of operation.
- Analyze the construction, working principle of Semiconductor Devices and Diode Circuits
- Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions
- Apply small signal low frequency transistor amplifier circuits using BJT and FET in different configurations

L	T	P	C
3	0	0	3

II Year-I Semester

SWITCHING THEORY and LOGIC DESIGN

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 functions implification using Karnaugh maps and Quine- McCluskey methods
- To understand concepts of combinational circuits.
- To develop advanced sequential circuits.

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. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

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, Realization of three level logic circuits.

UNIT–II
MINIMIZATION TECHNIQUES:
Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables) and tabular method (Quine-mccluskey method) with only four variables and single function.

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 and carry look-a- head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.

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 and seven segment decoder.
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INTRODUCTION OF PLD's:

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

UNIT–IV

SEQUENTIAL CIRCUITS-I:

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. Conversion from one flip-flop to another flip-flop. Design of 5 ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers – Buffer register, control buffer register, shift register, bi-directional shift register, universal shift, register

Study the following relevant Ics and the irrelevant functions 7474, 7475, 7476, 7490, 7493, 74121.

UNIT–V

SEQUENTIAL CIRCUITS-II:

Finite state machine; state diagrams, statetables, 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)

TEXTBOOKS:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009

2. Digital Design by M.Morris Mano, Michael Dciletti,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 CharlesH. RothJr, JaicoPublishers,2006

2. Digital electronics by RS Sedha, S. Chand & company limited,2010

3. Switching Theory and Logic Design by A.Anand Kumar, PHI Learning pvt ltd,2016.

4. Digital logic applications and design by John M Yarbough, Cengage learning, 2006.

5. TTL74-Seriesdatabook.

Course Outcomes:

- Classify different number systems and apply to generate various codes.
- Use the concept of Boolean algebra in minimization of switching functions
- Design different types of combinational logic circuits.
- Apply knowledge of flip-flops in designing of Registers and counters
- The operation and design methodology for synchronous sequential circuits and algorithmic state machines.
- Produce innovative designs by modifying the traditional design techniques.

II Year-I Semester

L	T	P	C
0	0	3	1.5

ELECTRONIC DEVICES AND CIRCUITS LAB

Note: The students are required to perform the experiment to obtain the V-I characteristics and to determine the relevant parameters from the obtained graphs.

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

1. Clipper circuit using diode
2. Clamping circuit using diode
3. Rectifiers (without and with c-filter)

   Part A:Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   Part A:Input Characteristics
   Part B:Output Characteristics
5. FET Characteristics (CS Configuration)
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT- CE Amplifier
11. Emitter Follower- CC Amplifier
12. FET- CS Amplifier

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
0	0	3	1.5

II Year- I Semester

SWITCHING THEORY and LOGIC DESIGN LAB

List of Experiments:
1. Verification of truthtables of the following Logic gates
   Two input (i)OR (ii)AND (iii)NOR (iv)NAND (v)Exclusive-OR (vi)Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3to8 –line Decoder /De-multiplexer
4. 4 variable logic function verification using 8to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of (i)JK Edge triggered Flip–Flop (ii)JK Master Slave Flip–Flop (iii) D 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 / JKFlip 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 and 7 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

II Year-I Semester

L	T	P	C
0	1	2	2

DATA STRUCTURES USING PYTHON

List of Experiments:

1. Write a Python program for class, Flower, that has three instance variables of type str, int, and float that respectively represent the name of the flower, its number of petals, and its price. Your class must include a constructor method that initializes each variable to an appropriate value, and your class should include methods for setting the value of each type, and retrieving the value of each type.

2. Develop an inheritance hierarchy based upon a Polygon class that has abstract methods area() and perimeter().Implement classes Triangle, Quadrilateral, Pentagon, that extend this base class, with the obvious meanings for the area( ) and perimeter( ) methods. Write a simple program that allows users to create polygons of the various types and input their geometric dimensions, and the program then outputs their area and perimeter

3. Write a python program to implement Method Overloading and Method Overriding.

4. Write a Python program to illustrate the following comprehensions: a) List Comprehensions b) Dictionary Comprehensions c) Set Comprehensions d) Generator Comprehensions

5. Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. Example: Original list:[1,2,3,4,5,6,7,8,9]
Combinations of 2 distinct objects:[1,2][1,3][1,4][1,5][7,8][7,9][8,9].

6. Write a program for Linear Search and Binary search.

7. Write a program to implement Bubble Sort and Selection Sort.

8. Write a program to implement Merge sort and Quick sort.

9. Write a program to implement Stacks and Queues.

10. Write a program to implement Singly Linked List.

11. Write a program to implement Doubly Linked list.

12. Write a program to implement Binary Search Tree.

L	T	P	C
3	0	0	3

II Year-II Semester

LINEAR CONTROL SYSTEMS

Course objectives:
- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis
- To develop the acquaintance in analyzing the system response in time - domain and frequency domain in terms of various performance indices
- To analyze the system in terms of absolute stability and relative stability by different approaches
- To design different control systems for different applications as per given specifications
- To introduce the concepts of state variable analysis, design and also the concepts of controllability and observability.

UNIT I - INTRODUCTION
Concepts of System, Control Systems: Open Loop and closed loop control systems and their differences. Different examples of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models, Differential equations, Impulse Response and transfer functions. Translational and Rotational mechanical systems

UNIT II – TRANSFER FUNCTION REPRESENTATION
Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples –Block diagram algebra–Representation by Signal flowgraph-Reduction using mason's gain formula.

TIME RESPONSE ANALYSIS
Standard test signals – Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications – Steady state response - Steady state errors and error constants.

UNIT III – STABILITY ANALYSIS IN S-DOMAIN
The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability100

Root Locus Technique:
The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT IV
Frequency response analysis: Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion

UNIT V – CLASSICAL CONTROL DESIGN TECHNIQUES

Compensation techniques – Lag, Lead, Lead-Lag Controllers design infrequency Domain, PID Controllers. State Space Analysis of Continuous Systems Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS:
1. Automatic Control Systems 8th edition– by B.C.Kuo – Johnwiley and son's, 2003.
2. Control Systems Engineering –by I. J.Nagrathand M.Gopal, New Age International (P) Limited, Publishers, 2nd edition, 2007
3. Modern Control Engineering–by Katsuhiko Ogata–Pearson Publications, 5th edition, 2015.

REFERENCE BOOKS:
1. Control Systems by A. Nagoor kani, RB A publications, 3 edition, 2017.
2. Control Systems by A. Anand kumar, PHI, 2 Edition, 2014.

Course Outcomes:
- This course introduces the concepts of feedback and its advantages to various control systems
- The performance metrics to design the control system intime-domain and frequency domain are introduced.
- Control systems for various applications can be designed using time-domain and frequency domain analysis.
- In addition to the conventional approach, the state space approach for the analysis of control systems is also introduced.

L	T	P	C
3	0	0	3

II Year - II Semester

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Course Objectives:

The main objectives of this course are to:

- Understand the fundamentals of electric fields, coulomb's law and gauss law
- Familiar with of Biot-Savart Law, Ampere's Circuital Law and Maxwell equations
- Aware of electromagnetic wave propagation in dielectric and conducting media
- Study the equivalent circuit of transmission lines and parameters of the transmission lines
- Learn the working of smith chart and its usage in the calculation of transmission line parameters

UNIT I:

Review of Co-ordinate Systems, **Electrostatics:** Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT II:

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems**.**

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.

UNIT III:

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.

UNIT IV:

Transmission Lines - I : Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems.

UNIT V:

Transmission Lines – II: Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.

TEXT BOOKS:

1. Elements of Electromagnetic – Matthew N. O. Sadiku, Oxford University Press, 7th edition, 2018.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2008.

REFERENCE BOOK:

1. Engineering Electromagnetics – William H. Hayt, John A. Buck, Jaleel M. Akhtar, TMH, 9th edition, 2020.
2. Electromagnetic Field Theory and Transmission Lines –G. S. N. Raju, Pearson Education 2006
3. Electromagnetic Field Theory and Transmission Lines: G SasiBhushana Rao,Wiley India 2013.
4. Networks, Lines and Fields John D. Ryder, Second Edition, Pearson Education, 2015.

Course Outcomes:

After learning the course, the student will be able to:
- Determine electric field intensity using coulomb's law and Gauss law.
- Determine magnetic field intensity using Biot-Savarts Law and Ampere's Circuital Law.
- Analyze the electromagnetic wave propagation in dielectric and conducting media.
- Examine the primary and secondary constants of different types of transmission lines.
- Derive the expressions for input impedance, reflection coefficient, and VSWR of transmission lines and calculate these parameters using smith chart.

II Year - II Semester

L	T	P	C
3	0	0	3

ELECTRONIC CIRCUIT ANALYSIS

Course Objectives:

The main objectives of this course are:

- To learn hybrid- π parameters a thigh 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.

UNIT-I Small Signal High Frequency Transistor Amplifier models:

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid πconductance, 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.

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.

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.

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.

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

Text Books:
1. Integrated Electronics- J.Millman and C.C.Halkias, Tata McGraw-Hill, 1972.
2. Electronic Devices and CircuitsTheory –Robert L.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, Mc GrawHill, 2010.
2. Micro electronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition, 2011.
3. Electronic Circuit Analysis-B.V. Rao, K.R. Rajeswari, P.C.R.Pantulu, K.B.R. Murthy, Pearson Publications.

Course Outcomes:
  At the end of this course the student can able to
- Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
- Design and analysis of multistage amplifiers using BJT and FET and Differential amplifier using BJT.
- Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.
- Know the classification of the power and tuned amplifiers and their analysis with performance comparison

II Year - II Semester

L	T	P	C
3	0	0	3

ANALOG COMMUNICATIONS

Course Outcomes:

At the end of the Course, Student will be able to:

- Describe the Modulation and Demodulation techniques of standard AM.
- Compare different types of Amplitude Modulation and Demodulation techniques.
- Analyse the concepts of generation and detection of Angle Modulated signals.
- Outline the Radio Receivers with different sections.
- Interpret the Radio Transmitters completely.
- Illustrate the noise performance in Analog Modulation techniques and also the concepts of Pulse Analog Modulation and Demodulation techniques.

Unit – I

Amplitude Modulation: Introduction to Fourier transform, Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Time domain and Frequency domain descriptions, Single tone modulation, Power relations in AM waves, Generation of AM waves: Square law Modulator, Switching modulator, Detection of AM Waves: Square law detector, Envelope detector, Related problems.

Unit – II

DSB & SSB Modulation: Double sideband suppressed carrier modulator: Time domain and frequency domain description, Generation of DSBSC Waves: Balanced Modulator, Ring Modulator, Detection of DSBSC Waves: Coherent detection, Quadrature Null Effect, COSTAS Loop, Squaring Loop.

Single sideband suppressed carrier modulator: Time domain and Frequency domain description, Generation of SSBSC Waves: Frequency discrimination method, Phase discrimination method, Demodulation of SSB Waves: Coherent Detection.

Vestigial sideband modulation: Time domain description, Frequency domain description, Generation of VSB Modulated wave, Envelope detection of a VSB Wave pulse Carrier, Comparison of different AM Techniques, Applications of different AM Systems, Related problems.

Unit – III

Angle Modulation: Introduction, Basic concept of phase modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave, Generation of FM Waves: Direct Method, Indirect Method, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM, Related problems.

Unit – IV

Radio Transmitters: Classification of Transmitters, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter: Variable reactance type and Phase modulated FM Transmitter, Frequency stability in FM Transmitter.

Radio Receivers: Receiver Types: Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics, Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Amplitude limiting, Comparison of FM & AM Receivers, Communication Receivers, Extension of super heterodyne principle and additional circuits.

Unit – V

Noise: Review of noise and noise sources, Noise figure, Noise in Analog communication Systems: Noise in DSB & SSB Systems, Noise in AM System and Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & De-emphasis.

Pulse Analog Modulation: Types of Pulse modulation, PAM (Single polarity, double polarity), PWM: Generation & Detection of PWM, PPM: Generation and Detection of PPM, Time Division Multiplexing, TDM Vs FDM.

Text Books:
1. Communication Systems, Simon Haykin, Michael Moher, Wiley, 5th Edition, 2009.
2. Principles of Communication Systems, H Taub, D L Schilling, Gautam Sahe, TMH, 4th Edition, 2017.
3. Modern Digital and Analog Communication Systems, B.P.Lathi, Zhi Ding, Hari Mohan Gupta, Oxford University Press, 4th Edition, 2017.

Reference Books:
1. Electronics & Communication Systems, George Kennedy, Bernard Davis, S R M Prasanna, TMH, 6th Edition, 2017.
2. Communication Systems, R P Singh, S D Sapre, TMH, 3nd Edition, 2017.
3. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, Katson Books, 7th Reprint Edition, 2018

L	T	P	C
0	0	3	1.5

II Year-II Semester

SIGNALS AND SYSTEMS LAB

I. Generation of Basic Signals (Analog and Discrete)
1. Unit step
2. Unit impulse
3. Unit Ramp
4. Sinusoidal
5. Signum

II. Operations on signals
1. Addition & Subtraction
2. Multiplication & Division
3. Maximum & minimum

III. Energy and power of signals, even and odd signals

IV. Transformation of the independent variable

1. Shifting (Delay & Advance)
2. Reversing
3. Scaling

V. Convolution & Deconvolution

VI. Correlation

VI. Fourier Series Representation

VIII. Fourier Transform and Analysis of Fourier Spectrum

IX. Laplace Transforms

X. Z-Transforms

L	T	P	C
0	0	3	1.5

II Year-II Semester

ELECTRONIC CIRCUIT ANALYSIS LAB

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: (Minimum of Ten Experiments has to be performed)
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. Boots trapped 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

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

Hardware Required:
1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

II Year II Semester

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I   Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II   Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III   Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV   Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V   Design Thinking in Business Processes
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine

business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5

L	T	P	C
0	1	2	2

II Year I Semester

EMBEDDED SYSTEMS & IoT
(For Mechanical)

Course Objectives:

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication link with Arduino
- To analyse basics of SPI interface.
- To interface Stepper Motor with Arduino
- To analyse Accelerometer interface techniques
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

Embedded Systems Experiments: (Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal. COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

Internet of Things Experiments: (Any 5 experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
4. Raspberry Pi interact with online services through the use of public APIs and SDKs.
5. Study and Install IDE of Arduino and different types of Arduino.

6. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
7. Calculate the distance using distance sensor Using Arduino.
8. Basic LED functionality Using Arduino.
9. Calculate temperature using temperature sensor Using Arduino.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

Text Books:
1. Arsheep Bahga &Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Comprehend Microcontroller-Transducers Interface techniques.	L4
CO2	Establish Serial Communication link with Arduino	L6
CO3	Analyse basics of SPI interface.	L4
CO4	Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.	L2
CO5	Realize the revolution of internet in mobile devices, cloud and sensor networks	L3

II Year – II Semester

L	T	P	C
3	0	0	3

ANALOG CIRCUITS
(For EEE)

Pre-requisite: Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra, and logic gates.

Course Objectives:
- To acquire the basic knowledge on clippers, clampers & biasing circuits.
- To determine the h-parameters of a transistor circuit & concepts of understand the feedback amplifiers.
- To know the operation of oscillators and operational amplifier.
- To understand the applications of operational amplifier.
- To acquire the knowledge on IC 555 timer and their applications.
- To know the operation of Analog to Digital Converters and Digital to Analog Converters.

Course Outcomes:
    At the end of the course, the student will be able to,
CO1**:** Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.
CO2**:** Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.
CO3**:** Understand operation of oscillators, operational amplifier and their applications.
CO4: Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications.
CO5: Describe the operation of different ADC's and DAC's.

Unit – 1:

Diode clipping and clamping circuits: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.
DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in V_{BE} and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

Unit – II:
Small Signals Modelling of BJT: Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.
Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output

and Input Resistances, Voltage-Series Feedback, Current-Series, Current shunt Feedback, Voltage-Shunt Feedback

Unit – III:
Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

Unit – IV:
OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

Unit – V:
Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

Digital to Analog And Analog to Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

Text books:
1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017. 27
3. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria& Sons, 2ndEdition, 2010.