

VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN  
B. Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING  
**COURSE STRUCTURE – VR25**

**II B. Tech. – I Semester**

S.No.	Course Code	Course	L	T	P	Credits
1	25EC301PC	Probability Theory and Stochastic Processes	3	0	0	3
2	25EC302PC	Signals and Systems	3	0	0	3
3	25EC303PC	Electronic Devices and Circuits	3	0	0	3
4	25EC304PC	Digital Logic Design	3	0	0	3
5	25EC305PC	Control Systems	2	0	0	2
6	25MS306BS	Innovation and Entrepreneurship	2	0	0	2
7	25EC307PC	Modelling and Simulation Lab	0	0	2	1
8	25EC308PC	Electronic Devices and Circuits Lab	0	0	2	1
9	25EC309PC	Digital Logic Design Lab	0	0	2	1
10	25CS310SD	Linux and Shell Scripting	0	0	2	1
11	25VA311BS	Environmental Science	1	0	0	1
		<b>Total</b>	<b>17</b>	<b>0</b>	<b>08</b>	<b>21</b>

**II B. Tech. - II Semester**

S.No.	Course Code	Course	L	T	P	Credits
1	25MA401BS	Numerical Methods and Complex Variables	3	0	0	3
2	25EC402PC	Electromagnetic Fields and Transmission Lines	3	0	0	3
3	25EC403PC	Analog and Digital Communications	3	0	0	3
4	25EC404PC	Electronic Circuit Analysis	3	0	0	3
5	25EC405PC	Linear and Digital IC Applications	3	0	0	3
6	25MA406BS	Computational Mathematics Lab	0	0	2	1
7	25EC407PC	Analog and Digital Communications Lab	0	0	2	1
8	25EC408PC	Electronic Circuit Analysis Lab	0	0	2	1
9	25EC409PC	Linear and Digital IC Applications Lab	0	0	2	1
10	25IT410SD	Web and Mobile Applications	0	0	2	1
		<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>20</b>

Note: L - Theory

T - Tutorial

P - Practical

C - Credits

<b>B.Tech.ECE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>II Year-I Semester</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **PROBABILITY THEORY AND STOCHASTIC PROCESSES**

**Prerequisite:** Mathematics

**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.

**Course Outcomes:** Upon completing this course, the student will be able to

- 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..
- Analyze the properties of stochastic processes, such as correlation, covariance, and spectral density

#### **UNIT-I: Probability**

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 Variables- 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 Random Variable**

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 and Discrete Random Variable, Computer generation of a Random Variable of a given PDF/CDF.

#### **UNIT-III: Multiple random variables and Operations on Multiple random variables**

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central

Limit Theorem, Equal and Unequal Distribution (Proof not expected). 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-IV: 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. 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-V: 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.

**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.

#### **Text Books:**

1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles - TMH, 4th Edition
2. Murray R Spiegel, John Schiller, R Alu Srinivasan. – Probability and Statistics – Schaum’s Outlines, 2nd Edition, TMH

#### **Reference Books:**

1. P Ramesh Babu - Probability Theory and Random Processes – McGraw Hill Education
2. Athanasios Papoulis and S. Unnikrishnan Pillai - Probability, Random Variables and Stochastic Processes – McGraw Hill Education, 4th Edition
3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly - Probability Theory and Stochastic Processes for Engineers - Pearson, 1st Edition, 2011
4. Taub and Schilling - Principles of Communication systems by (TMH), 2008 Y Mallikarjuna Reddy - Probability Theory and Stochastic Processes, 4th Edition, University Press.

**B.Tech.ECE****L T P C****II Year-I Semester****3 0 0 3****SIGNALS AND SYSTEMS****Prerequisite:** Mathematics**Course Objectives:** This subject gives the basics of Signals and Systems required for all Electrical Engineering related courses. The objectives of this subject are to:

- Classify signals and systems and their analysis in time and frequency domains.
- Study the concepts of distortion less transmission through LTI Systems, convolution and correlation properties.
- Understand Laplace and Z-transforms their properties for analysis of signals and systems.
- Identify the need for sampling of CT signals, types and merits and demerits of each type

**Course Outcomes:** Upon completing this course, the student will be able to:

- Characterize various signals, systems and their time and frequency domain analysis, using transform techniques.
- Identify the conditions for transmission of signals through systems and conditions for physical realization of systems
- Understand the significance of sampling theorem for baseband and band-pass signals for various types of sampling and for different duty cycles
- Understand the concept of correlation and PSD functions and their applications.
- Use sampling theorem for baseband and band-pass signals for various types of sampling and for different duty cycles

**UNIT-I: Signal Analysis**

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, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

**UNIT-II: Fourier series**

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

### **UNIT-III: Signal Transmission through Linear Systems**

Linear System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. Extraction of Signal from Noise by Filtering. Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and risetime. Extraction of Signal from Noise by Filtering.

### **UNIT-IV: Laplace Transforms**

Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Correlation:** Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Parseval's Theorem, Detection of Periodic Signals in the presence of Noise by Correlation.

### **UNIT-V: Sampling theorem**

Graphical and analytical proof of Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flat-top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing

**Z-Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

#### **Text Books:**

1. Signals, Systems & Communications -B.P. Lathi, BS Publications.
2. Signals and Systems – Allan. V. Oppenheim, Allan. S. Willsky with S. Hamid. Nawab, 2nd Ed. Pearson.

#### **Reference Books:**

1. Signals and Systems–Simon Haykin, Barry Van Veen, 2nd Ed., Wiley.
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH.
3. Fundamentals of Signals and Systems – Michel J. Roberts, Govind Sharma, 2nd Ed., MGH.
4. Signals, Systems and Transforms - Charles. L. Philips, John M. Parr and Eve A. Riskin, 4th Ed., 2004, Pearson, Prentice Hall.

B.Tech.ECE

L T P C

II Year-I Semester

3 0 0 3

### ELECTRONIC DEVICES AND CIRCUITS

**Prerequisite:** Mathematics

#### Course Overview:

This course introduces fundamental semiconductor devices and their behavior, including diodes, BJTs, and FETs. It covers their characteristics, applications, and the analysis of basic electronic circuits. The course also explores rectifiers, voltage regulation, amplifier design, and advanced semiconductor technologies like Fin FETs and CNTFETs. Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics.

**Course Outcomes:** By the end of this course, students will be able to:

- Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits.
- Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics.
- Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications.
- Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations.
- Analyze the structure, working, and characteristics of JFETs, MOSFETs, and advanced devices like Fin FETs and CNTFETs, and compare modern device technologies.

#### UNIT-I: Diode Characteristics and Applications

PN junction diode – I-V characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piecewise Linear), Rectifiers – Half-wave, Full wave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode – I-V characteristics and voltage regulation..

#### UNIT-II: Bipolar Junction Transistor (BJT)

Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

#### UNIT-III: BJT Biasing

Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

#### **UNIT-IV: Transistor Amplifiers**

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor., Detection of Periodic Signals in the presence of Noise by Correlation

#### **UNIT-V: Special Purpose Diodes**

Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode

**Field Effect Transistors and Advanced Devices:** JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics, Advanced Devices: Fin FETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. Fin FET vs. CNTFET..

#### **Text Books:**

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. Tata McGraw-Hill, 1991.
2. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. Pearson, 11th ed., 2013.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. Oxford University Press, 7th ed., 2014.

#### **Reference Books:**

1. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 5th ed., 2008.
2. Neamen, Donald A. Electronic Circuit Analysis and Design. McGraw-Hill, 2nd ed., 2001.
3. Salivahanan, S., and N. Suresh Kumar. Electronic Devices and Circuits. McGraw-Hill Education, 4th ed., 2017
4. Razavi, Behzad. Fundamentals of Microelectronics. Wiley, 2nd ed., 2013.
5. Taur, Yuan, and Tak H. Ning. Fundamentals of Modern VLSI Devices. Cambridge University Press, 2nd ed., 2009

**B.Tech.ECE**

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**II Year-I Semester**

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### **DIGITAL LOGIC DESIGN**

#### **Course Overview:**

This course introduces students to the fundamental principles of digital logic design. Starting from Boolean algebra and its simplification techniques, it covers the formal analysis and design of combinational and sequential circuits. Additionally, the course addresses memory elements and programmable logic devices, which are essential building blocks for complex digital systems

**Course Outcomes:** Upon completion, students will be able to:

- Apply Boolean algebra and minimization techniques to simplify Boolean functions.
- Design combinational circuits using logic gates.
- Analyze latches and flip-flops to design sequential logic circuits.
- Construct synchronous sequential circuits combining flip-flops and logic gates.
- CO5: Utilize programmable logic devices in digital system design
- Basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems

#### **UNIT-I: Number Systems**

Binary, Octal, Decimal, Hexadecimal, Fixed-point and Floating-point Number Representations, Complements of Numbers: 1's and 2's Complement, Error Detection and Correction Codes: Parity Check, Hamming Code.

**Boolean Algebra and Logic Gates:** Axiomatic definitions, basic theorems and properties, Boolean Functions: Canonical and standard forms, Digital Logic Gates Overview.

#### **UNIT-II: Gate-Level Minimization Techniques**

Karnaugh maps: 2, 3, and 4 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, Don't care conditions, Implementation using NAND and NOR gates..

#### **UNIT-III: Combinational Logic Circuits**

Analysis and design procedures, Binary adder-subtractor and BCD adder, magnitude comparator, decoders, encoders, multiplexers and demultiplexers.

#### **UNIT-IV: Sequential Logic Circuits**

Gated latches, Flip-flops: Clocked S-R, D, T, JK, Master-Slave JK, Design of synchronous and asynchronous counters, Shift registers: types and applications.

#### **UNIT-V: Synchronous Sequential Logic**

Moore and Mealy state machines, State diagrams, state tables, and state reduction, Case studies: sequence detector, traffic light controller, vending machine.

**Programmable Logic Devices:** Memory devices - RAM, ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

#### **Text Books:**

1. M. Morris Mano, Michael D. Ciletti, Digital Design with an Introduction to the Verilog HDL, 6th Edition, Pearson Education/PHI, 2017.

**Reference Books:**

1. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems: Principles and Applications, 10th Edition, Pearson Education.
2. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, 6th Edition, Cengage Learning.

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<b>II Year-I Semester</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

### **CONTROL SYSTEMS**

**Pre-Requisites:** Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

**Course Objectives:**

- To introduce the fundamental concepts, classifications, and mathematical modeling of control systems for mechanical and electrical domains.
- To analyze control system behavior in time and frequency domains and stability criteria using root locus, Bode plot, Nyquist plot, etc.
- Design and evaluate compensators and controllers to improve system performance.
- Explain state-space representation, solution of state equations, and assess system controllability and observability.

**Course Outcomes:** Upon completion of this Course, the students will be able to:

- Describe open- and closed-loop systems and develop mathematical models using block diagrams and signal flow graphs.
- Analyze time response of second-order systems using time-domain specifications and assess stability using Routh-Hurwitz criterion and root locus techniques.
- Analyze frequency response plots including Bode, Polar, and Nyquist plots, and investigate system stability.
- Design compensators and controllers to meet specific performance criteria in control systems.
- Apply the state-variable approach and analyze controllability and observability.

**UNIT-I: Control System fundamentals**

Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs.

**UNIT-II: Time response Analysis**

Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability. Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

**UNIT-III: Frequency response Analysis**

Frequency domain specifications, bode plots, Gain margin and Phase Margin. Polar plot, Nyquist plot, and Nyquist criterion for stability.

**UNIT-IV: Compensators and controllers**

Introduction to compensators, Lag compensator, Lead compensator, Lag- Lead compensator, Design of compensators using bode plot. Introduction to controllers, P, I, D, PI, PD, PID controllers.

## **UNIT-V: State space representation**

Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability.

### **Text Books:**

1. I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009.
2. Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010.

### **Reference Books:**

1. K. Ogata, Modern Control Engineering, 2ed., Prentice Hall, 2010.
2. M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997.
3. Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007.
4. A.K. Jairath, Solutions and Problems of Control Systems, CBS Publishers, 2013.
5. A. Nagoor Kani, Control Systems, 2ed., RBA Publications, 2007.

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<b>II Year-I Semester</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

### **INNOVATION AND ENTREPRENEURSHIP**

#### **Course Objectives:**

- To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
- To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
- To initiate prototype development and understand minimum viable product.
- To develop initial Business and financial planning and Go-to-Market strategies
- To impart knowledge on establishing startups, venture pitching and IPR

#### **Course Outcomes:**

- Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
- Assess the problem from an industry perspective and generate solutions using the design thinking principles.
- Assess market competition, estimate market size, and develop a prototype.
- Analyze Business and financial planning models and Go-to-Market strategies.
- Able to build a start-up, register IP and identify funding opportunities.

#### **UNIT-I: Fundamentals of Innovation and Entrepreneurship Innovation**

Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation. Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus. Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

#### **UNIT-II: Problem and Customer Identification**

Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem. Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

#### **UNIT-III: Opportunity assessment and Prototype development**

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.

Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

#### **UNIT-IV: Business & Financial Models**

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy. Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities

#### **UNIT-V: Startups and IPR**

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features. Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities..

#### **Suggested Readings:**

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Startup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.  
NISP -[Brochure inside pages - startup policy 2019.pdf](#)

B.Tech.ECE

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II Year-I Semester

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**MODELLING & SIMULATION LAB****Note:**

- Minimum of 12 experiments are to be completed / simulated.
- All the experiments are to be simulated using MATLAB or equivalent software

**Course outcomes:**

- Will be able to use a simulation tool for generating, analyzing and performing various operations on Signals / Sequences both in time and Frequency domain
- Will be able to use a simulation tool for Analyzing and Characterizing Continuous and Discrete Time Systems both in Time and Frequency domain along with the concept of Sampling
- Will be able to use a simulation tool for generating different Random Signals; analyzing their Characteristics by finding different higher order Moments and noise removal applications
- Will be able to use a Simulink for Control System applications

**List of Experiments:****Signals and Systems (Minimum 7 Experiments)**

1. Write the code / script for generating various standard viz: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using Waveform synthesis. Also, for perform different operations viz: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.
2. Write the code / script for finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal.
3. Write the code / script for finding the output of a System for a given input and Impulse Response and finding Auto Correlation and Cross Correlation of Signals / sequences
4. Write the code / script for Verifying whether a given Continuous/Discrete System is Linear, Time Invariant, Stable and Physically Realizable
5. Write the code / script for obtaining Sinusoidal response and Impulse response of a given Continuous / Discrete LTI System.
  - a) Plot the Real and Imaginary part and
  - b) Magnitude and Phase Plot of the response
6. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Fourier Transform by using the properties wherever required.
7. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Laplace Transform by using the properties where

- ever required. Also plot pole-zero diagram in S-plane
8. Write the code/ script for finding and plotting the Magnitude and Phase Spectrum of any given Sequence by finding its Z-Transform by using the properties wherever required. Also plot pole – zero diagram in Z-plane
  9. Design a Simulink or equivalent model for
    - a) Solving Differential Equations
    - b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses.
  10. Gibbs Phenomenon and waveform synthesis

### **Probability Theory and Stochastic Processes (Minimum 3 Experiments)**

11. Write the code / script for generating various Random Variables with different CDFs/ PDFs
12. Write the code / script for generating Gaussian noise and for finding its mean, Skewness, Kurtosis, PDF and PSD.
13. Write the code / script for Verifying Sampling theorem for different sampling rates, Sampling types and Duty Cycles and for plotting the sampled and reconstructed Signals.
14. Write the code / script for Removal of noise from the signal using Cross correlation.
15. Write the code / script for Extraction of Periodic Signal masked by noise using Auto Correlation

### **Control Systems (Minimum 2 Experiments)**

16. Build and Simulate a DC Motor using Simulink
17. Implementation of a PID Controller from equations using Simulink
18. Controllability and Observability

**Note:** For the experiments with code/scripts written in MATLAB or equivalent (1-8, 11-15), the student can design a user interface or app using MATLAB App Designer or equivalent.

### **Application on Real Time signals**

1. Application of Autocorrelation: GPS Synchronization Satellite communication toolbox is required for this experiment. Generate the GPS signal. Visualize the GPS signal. Plot of autocorrelation of C/A code and visualize the spectrum of GPS signals. For exact steps, go through the following page:  
<https://www.mathworks.com/help/satcom/ug/gps-waveform-generation.html>
2. Sampling of Speech Signals  
Record and play speech in MATLAB. For steps, go through the following page:  
[https://in.mathworks.com/help/matlab/import\\_export/record-and-play-audio.html](https://in.mathworks.com/help/matlab/import_export/record-and-play-audio.html)  
Change the sampling rate of the recorded speech signal and play back to see the effect of aliasing. For steps, go through the following page:  
<https://in.mathworks.com/help/signal/ug/changing-signal-sample-rate.html>

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**ELECTRONIC DEVICES AND CIRCUITS LAB**

**Course overview:**

This laboratory course aims to provide hands-on experience and simulation-based learning of semiconductor devices and basic electronic circuits. Students will analyze the characteristics and applications of diodes, BJTs, and FETs, design rectifiers and amplifiers, and simulate modern electronic circuits using software tools. The course bridges theoretical concepts with practical implementation, developing foundational skills essential for analog electronics and circuit analysis.

**Course Outcomes (COs):** By the end of this course, students will be able to:

- Analyze the I–V characteristics of semiconductor devices such as diodes, BJTs, and FETs.
- Design and evaluate basic rectifier, clipper, clamper, and voltage regulation circuits.
- Demonstrate biasing techniques for BJTs and determine their operating point using DC load line analysis.
- Design and analyze transistor amplifier circuits in various configurations using h-parameter models.
- Simulate and interpret electronic circuits using appropriate simulation tools.

**List of Experiments**

**A. Hardware-Based Experiments (7):**

1. Study the I–V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
5. Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance and current gain.
6. Design and test fixed bias and voltage divider bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.
7. Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain ( $\alpha$ ) and input/output resistance.

**B. Software-Based Simulation Experiments (7):**

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform

- smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
  3. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification.
  4. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
  5. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and trans conductance.
  6. Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
  7. Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

**Hardware Requirements:**

1. Regulated DC Power Supply (0–30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

**Software Requirements (Any one of the listed tools or equivalent):**

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

B.Tech.ECE

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II Year I Semester

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**DIGITAL LOGIC DESIGN LABARATORY****Course Overview:**

This laboratory course provides hands-on experience with the design, analysis, and simulation of digital circuits. Students begin by constructing and testing basic digital components using logic gate ICs, covering Boolean minimization, arithmetic circuits, code converters, and combinational building blocks. The second part focuses on implementing equivalent and advanced designs using Verilog HDL, exploring various modeling styles—dataflow, behavioral, and structural—along with simulation tools. The course emphasizes both foundational logic principles and modern digital system development practices.

**Course Outcomes (COs):** After completing this course, students will be able to:

- Analyze and simplify Boolean expressions and implement them using logic gates and ICs.
- Design and realize combinational and sequential logic circuits using logic gate hardware.
- Model digital systems in Verilog HDL using dataflow, behavioral, and structural styles.
- Simulate and verify digital designs using industry-standard EDA tools and test benches.
- Build modular and hierarchical designs such as counters, FSMs, and shift registers.

**List of Experiments:****A. Realization in Hardware Laboratory (Using Logic ICs)**

These are fundamental hands-on experiments conducted using logic ICs such as AND, OR, NOT, NAND, NOR XOR gates, flip-flops, multiplexers, and decoders.

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.
3. Construct and analyze basic logic gates (AND, OR, NOT, XOR, XNOR) using only NAND and NOR gates.
4. Design and implement parity bit generators (even and odd) and a 4-input majority logic circuit.
5. Design and implement code converters such as Binary to Gray, Gray to Binary, and BCD to Excess-3 using gates
6. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7segment decoder logic

**B. Verilog HDL-Based Digital Design Experiments (Simulation-Based)**

These experiments are implemented using **Verilog HDL** with different modeling styles (dataflow, behavioral, structural) and simulated using tools like **Vivado, ModelSim, or**

**Xilinx ISE.**

1. Design and simulate a 2-bit comparator using dataflow modeling; extend it to 4-bit using structural modeling.
2. Implement a 2:1 multiplexer using dataflow modeling and design an 8:1 multiplexer using structural modeling.
3. Design a 2-to-4 decoder using dataflow modeling and realize a 3-to-8 decoder using structural modeling.
4. Implement a given Boolean function using a decoder-based approach in behavioral modeling.
5. Design and simulate a universal n-bit shift register (left, right, hold, parallel load) using behavioural modeling.
6. Design a synchronous MOD-n counter using behavioral modeling with D or JK flip-flops.
7. Design and simulate an asynchronous (ripple) counter for a custom sequence using structural modeling.
8. Implement a sequence detector for a given binary pattern using FSM (Moore/Mealy) in behavioral modeling.

**Required Hardware (for Hardware Lab Experiments)**

<b>Component</b>	<b>Description</b>
Digital Trainer Kit	Breadboard with power supply and clock generator
Logic ICs	7400 (NAND), 7402 (NOR), 7408 (AND), 7432 (OR), 7486 (XOR), 7404 (NOT), etc.
Flip-Flop ICs	7474 (D Flip-Flop), 7476 (JK Flip-Flop)
MUX/Decoder ICs	74153, 74138, 74139
LEDs, switches, connecting wires	For I/O interface and testing

**Required Software Tools (for Verilog HDL Experiments) (Any one of the tool below)**

<b>Software Purpose</b>	<b>Description</b>
Xilinx Vivado	HDL simulation and synthesis (preferred tool)
ModelSim	Verilog simulation and waveform analysis
Xilinx ISE	Legacy support for simulation and FPGA design

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<b>II Year-I Semester</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **LINUX AND SHELL SCRIPTING**

**Course Outcomes:** By the end of the course, students will be able to:

- Understand Linux system structure, OS architecture, and command-line environment.
- Perform Linux installation and basic administration including file, user, and permission management.
- Develop shell scripts to automate tasks such as backups, monitoring, and data processing.
- Use Linux tools for software management, networking, and service configuration.
- Implement backup, recovery, and basic troubleshooting techniques through practical labs..

#### **Week 1: Introduction to OS Concepts**

**Lab Activity:** Linux History, Open-source software basics & Licenses, Why Linux vs windows Identify system and application software on your PC. Differentiate their roles and explain basic OS functions.

#### **Week 2: Linux Architecture & Kernel Types**

**Lab Activity:** Compare Monolithic and Microkernel architectures using diagrams. Discuss how Linux's structure supports device-level control.

#### **Week 3: Installing Linux (Ubuntu/CentOS)**

**Lab Activity:** Install Linux using Virtual Box or WSL. Document each installation step and trouble shoot any permission or hardware issues.

#### **Week 4: Linux Filesystem & Navigation**

**Lab Activity:** Navigate key directories like /home, /etc., and /var. Create folder structures for a team project.

#### **Week 5: File Permissions & Ownership**

**Lab Activity:** Set permissions on project folders so only group members can access/edit them. Verify permissions using multiple users.

#### **Week 6: User and Group Management**

**Lab Activity:** Create users and groups for a coding team. Set up shared access using group permissions and configure hidden config files.

#### **Week 7: Process Management**

**Lab Activity:** Identify and terminate frozen or unresponsive processes during compilation using commands like ps and top.

#### **Week 8: Process Priorities & Memory Tools**

**Lab Activity:** Adjust priority of background jobs using nice and monitor system memory usage with vmstat and free. Display information about the processes using top and kill the applications/processes with the task id

## **Week 9: Shell Scripting Basics**

**Use Case:** System Info Script for Lab Login

### **Lab Activity:**

Create a shell script that automatically displays system uptime, current date/time, available disk space, and active users each time a lab user logs in. Use variables and echo statements to present the information in a readable format.

## **Week 10: Loops, Functions, and Cron Jobs**

**Use Case:** Automated Backup Scheduler for Project Folders

### **Lab Activity:**

Write a shell script that loops through all user folders in /home and backs them up to a predefined backup location. Add functions for logging success/failure. Schedule it to run daily at 2 AM using cron. Handle missing folders gracefully.

## **Week 11: Package Management & Archiving**

**Use Case:** Setting Up Developer Environment + Archiving a Project

### **Lab Activity:**

Use apt (Ubuntu) or yum (CentOS) to install essential tools like vim, curl, or git. Archive a project directory using tar or zip. Use sha256sum to verify archive integrity before transferring it to another system.

Installation of applications using apt, apt-get, yum, dnf, snap, or brew commands. Setup python virtual environment

## **Week 12: Text Processing & Networking Utilities**

**Use Case:** Security Log Analysis & Network Check After Intrusion Alert

### **Lab Activity:**

Analyze /var/log/auth.log or /var/log/secure to detect failed login attempts using grep, awk, cut, and sort. Use ping, traceroute, netstat, nbtstat, arp and scp to check remote system connectivity and transfer reports securely.

Concepts of Linux clusters, Virtual machines (virtual box in chapter 3), creating VMs, allocating resources, interconnection between VMs, Containers concepts

## **Week 13: Service Management & Disk Mounting**

**Use Case:** Adding Extra Storage Without Reboot

### **Lab Activity:**

Create a new virtual disk in Virtual Box. Partition and format it. Mount it to /mnt/data and ensure it auto-mounts on reboot. Enable a required service (like ssh or apache2) using system ctl and check its status.

## **Week 14: Backup & Recovery**

**Use Case:** Disaster Recovery After Accidental Deletion

### **Lab Activity:**

Use a backup script to create a backup of critical folders. Simulate file deletion and restore them using your backup. Analyze /var/log/syslog or equivalent to trace user activity that led to the issue.

## **Week 15: Mini Project – Tool Development**

**Use Case:** Custom Shell Tool for New Employee Onboarding or Admin Task

### **Lab Activity:**

Develop a complete shell-based tool. Examples:

- A user account creation wizard for new employees
- A disk usage monitoring alert system
- A log cleaner tool that archives and clears logs weekly

Include user prompts, help menu, error checks, and logging features.

**Week 16: Final Demo & Viva**

**Use Case:** Present Your Solution to the Faculty Team

**Lab Activity:**

Demonstrate your mini project. Explain your code, how it solves the problem, test cases handled, and improvements you'd make. Submit your code with screenshots, logs, and a short user manual or README

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<b>II Year-I Semester</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

### ENVIRONMENTAL SCIENCE

#### Course Objectives

- Understand the components, structure, and functions of ecosystems and their relevance human society.
- Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
- Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
- Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
- Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

#### Course Outcomes:

- Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
- Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
- Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
- Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
- Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

#### UNIT-I: Ecosystems

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

#### UNIT-II: Natural Resources

**Classification of Resources:** Living and Non-Living resources

**Water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems.

**Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources

**Land resources:** Forest resources

**Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

### **UNIT-III: Biodiversity and Biotic Resources**

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

### **UNIT-IV: Environmental Pollution and Control Technologies: Environmental Pollution**

Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil.

**Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management.

**Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation.

**Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions /Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

### **UNIT – V: Environmental Policy, Legislation & EIA**

Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Contemporary Environmental Issues Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements..

#### **Text Books:**

1. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
3. Environmental Studies by R. Rajagopalan, Oxford University Press.

#### **Reference Books:**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008  
PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela.

2008 PHI Learning Pvt. Ltd.

3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

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<b>II Year-II Semester</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### NUMERICAL METHODS AND COMPLEX VARIABLES

**Pre-requisite:** Mathematics courses of first year of study.

**Course Objectives:** To learn

- Expressing periodic function by Fourier series and a non-periodic function by Fourier transforms
- Various numerical methods to find roots of polynomial and transcendental equations.
- Concept of finite differences and to estimate the value for the given data using interpolation.
- Evaluation of integrals using numerical techniques
- Solving ordinary differential equations of first order using numerical techniques.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

**Course outcomes:** After learning the contents of this paper, the student must be able to

- Express any periodic function in terms of sine and cosine.
- Find the root of a given polynomial and transcendental equations.
- Estimate the value for the given data using interpolation
- Find numerical solutions for a given first order ODE's
- Analyze the complex function with reference to their analyticity and integration using Cauchy's integral and residue theorems.
- Taylor's and Laurent's series expansions in complex function.

#### UNIT-I: Fourier Series & Fourier Transforms

**8 L**

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

#### UNIT-II: Numerical Methods-I

**10 L**

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton- Raphson method and Regula-Falsie method. Finite differences: forward differences – backward differences – central differences – symbolic relations – Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

#### UNIT-III: Numerical Methods-II

**10 L**

Numerical integration: Trapezoidal rule - Simpson's 1/3rd and 3/8th rules.

Ordinary differential equations: Taylor's series – Euler's method – Runge-Kutta method of fourth order for first order ODE.

**UNIT-IV: Complex Differentiation****10 L**

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne-Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

**UNIT-V: Complex Integration****10 L**

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

**Reference Books:**

1. Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D., Dennis
2. Spellman, Ph.D., Complex Variables (Schaum's outline).
3. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering
4. Computations, New Age International publishers.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

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II Year-II Semester	3	0	0	3

### ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

**Prerequisite:** Mathematics

**Course Objectives:**

- To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields and apply them to solve physics and engineering problems.
- To distinguish between static and time-varying fields and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to Communication engineering problems.
- To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
- To analyze the propagation of waves in transmission line and able to solve transmission line problem using Smith Chart.

**Course Outcomes:** Upon completing this course, the student will be able to

- Acquiring knowledge of Basic Laws, Concepts and Solving problems related to Electrostatic Fields and Magnetostatics Fields.
- Differentiate the static and time-varying EM fields and apply Maxwell's Equations at different Boundaries.
- Able to classify conductors and dielectric materials and analyze the Wave Propagations in those mediums.
- To solve transmission line problems numerically and using smith charts.
- Analyze the Design aspect of transmission line parameters and configurations

**UNIT-I: Electrostatics**

Review of Coordinate Systems & Vector Calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its applications, Electric Potential, Relation between E and V, Maxwell's Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors–Parallel Plate, Coaxial, Spherical.

**UNIT–II: Magneto statics**

Biot-Savart's Law, Ampere's Circuit Law and its applications, Magnetic Flux Density, Maxwell's equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

### **UNIT-III: Maxwell's Equations (Time Varying Fields)**

Faraday's Law, Transformer and Motional EMF, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations in Differential, Integral and Phasor form. Electric and magnetic Boundary Conditions (Dielectric – Dielectric, Conductor– Dielectric, Conductor– Free Space interfaces).

### **UNIT-IV: EM Wave Characteristics**

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves– Definitions, Relation between E&H, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin Depth, Surface Impedance, Wave Polarization. Poynting Vector and Poynting Theorem.

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,

### **UNIT-V: Transmission Lines**

Types, Parameters, Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless Lines, Types of Distortions, condition for Distortion less transmission lines, Minimum Attenuation, Loading – Types of Loading, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Impedance Transformations -  $\lambda/4$ ,  $\lambda/2$ ,  $\lambda/8$  Lines, Smith Chart-Configuration and Applications, Single Stub Matching.

#### **Text Books:**

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill, 2014
2. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Asian Edition, 2015.

#### **Reference Books:**

1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, 2nd Ed., PHI, 2000.
2. Engineering Electromagnetics – Nathan Ida, 2nd Ed., Springer (India) Pvt. Ltd., New Delhi, 2005.
3. Electromagnetic Field Theory Fundamentals – Bhag Singh Guru and Hussey in R. Hiziroglu, Cambridge University Press, 2nd Ed., 2006.

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II Year-II Semester

3 0 0 3

**ANALOG AND DIGITAL COMMUNICATIONS****Prerequisite:** Signals and Systems**Course Objectives:**

- To develop ability to analyze system requirements of analog and digital communication systems.
- To understand the generation, detection of various analog and digital modulation techniques.
- To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
- To understand the concepts of baseband transmissions.

**Course Outcomes:** Upon completing this course, the student will be able to:

- Design and analyze various Analog and digital Modulation and Demodulation techniques.
- Understand the effect of noise present in continuous wave Modulation techniques.
- Understand the concept of Super heterodyne Receiver and Pulse Modulation Techniques
- Analyze and design the various coding techniques and Base band Transmission.
- Acquire the knowledge of each block in AM, FM transmitters and receivers.

**UNIT-I: Amplitude Modulation**

Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation – Switching modulator, Detection - Envelope detector, DSB-SC Modulation: Generation – Balanced Modulator, Detection- Synchronous detector, COSTAS Loop, SSB Modulation: Time and frequency domain description, Generation – Phase discrimination Method and Demodulation – coherent detection, Vestigial side band modulation and demodulation.

**Angle Modulation**

Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson's Rule, Generation of FM Waves- Armstrong Method, Detection of FM Waves - Phase locked loop, Comparison of FM and AM.

**UNIT-II: Transmitters & Receivers**

Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Stereo FM multiplex reception, Comparison of AM and FM Receiver. Noise analysis in AM, DSB, SSB and FM Modulation System, Threshold effect in Angle Modulation System, Pre- emphasis, and de-emphasis

**Pulse Modulation**

Types of Pulse modulation-PAM, PWM and PPM, Comparison of FDM and TDM..

**UNIT-III: Detection and Estimation**

Model of Digital Communication Systems, Geometric Interpretation of Signals, Gram-Schmidt Orthogonalization, Response of Bank of correlators to Noisy Input, Detection of Known Signals in Noise, Probability of error, Optimum Receivers Using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Detection of signals with unknown Phase in Noise Base Band Shaping for Data Transmission: Requirements of a line

encoding format, various line encoding formats- Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist criterion, Correlation coding: Duobinary signaling, Modified Duobinary technique, generalized form of correlation coding, Eye pattern.

#### **UNIT-IV: Digital Modulation Techniques:**

PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM. Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Coherent quadrature modulation techniques (QPSK), Non Coherent binary modulation techniques (BFSK, DPSK), QAM, M-ary modulation techniques (PSK, FSK, QAM), Comparison of M-ary digital modulation techniques, power spectra, bandwidth efficiency, constellation diagrams...

#### **UNIT-V: Information theory**

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

#### **Text Books:**

1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5<sup>th</sup> Edition, PHI, 2009.
2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019.
3. Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam Saha, 3<sup>rd</sup> Edition, McGraw-Hill, 2008.

#### **Reference Books:**

1. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5th edition, 2022

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II Year-II Semester

3 0 0 3

**ELECTRONIC CIRCUIT ANALYSIS****Course Overview:**

The Electronic Circuit Analysis course provides foundational and advanced knowledge in the design and analysis of analog electronic circuits. This includes the study of multistage amplifiers, feedback amplifiers, oscillators, power amplifiers, and multi vibrators. Emphasis is placed on frequency response, feedback theory, transistor behavior at high frequencies, and waveform generation techniques. The course equips students with the necessary analytical and practical skills required in analog circuit design and communication systems.

**Course Outcomes:** By the end of this course, students will be able to:

- Analyze and classify multistage amplifier configurations and determine the impact of coupling schemes on amplifier performance and frequency response.
- Apply the hybrid- $\pi$  transistor model to evaluate high-frequency behavior of common-emitter amplifiers and calculate gain-bandwidth product.
- Examine feedback amplifier types and assess the influence of negative feedback on gain stability, bandwidth, and distortion.
- Design and analyze LC, RC, and crystal oscillators based on the Barkhausen criterion to generate sinusoidal waveforms.
- Design power amplifiers and multivibrator circuits, and evaluate their performance in terms of efficiency, distortion, and waveform generation.

**UNIT-I: Multistage Amplifiers:**

Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of multistage amplifiers, Transistor configuration choice in cascade amplifiers, Cascade and Cascode amplifiers, Darlington pair amplifier.

**High-Frequency Transistor Model:** Hybrid- $\pi$  model, Hybrid- $\pi$  parameters: Conductance and capacitances, CE short-circuit current gain, Gain with resistive load and gain-bandwidth product

**UNIT-II: Feedback Amplifiers**

Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, Characteristics of negative feedback: Gain stability, bandwidth, noise, distortion, Voltage series, Voltage shunt, Current series, Current shunt configurations.

**UNIT-III: Oscillator**

Principle of positive feedback, Barkhausen Criterion for oscillations, LC Oscillators: Generalized analysis, Hartley, Colpitts, RC Oscillators: RC phase shift, Wien bridge, Crystal oscillator: Working and advantages

#### **UNIT-IV: Power Amplifiers**

Classification: Class A, B, AB, C, Series-fed Class A amplifier, Transformer-coupled Class A amplifier, Class B amplifier: Push-pull, Complementary symmetry, Efficiency calculations and Cross over distortion.

#### **UNIT-V: Multi vibrators**

Analysis and design of Bistable, Monostable and A stable multi vibrators and Schmitt Trigger using transistors. Time Base Generators: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Linearity improvement techniques

#### **Text Books:**

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. McGraw-Hill Education, 2008.
2. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 2008.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. 7th ed., Oxford University Press, 2015.

#### **Reference Books:**

1. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2013.
2. Millman, Jacob, and Arvin Grabel. Microelectronics. 2nd ed., McGraw-Hill, 1987.
3. Malvino, Albert Paul. Electronic Principles. 7th ed., McGraw-Hill Education, 2007.
4. Millman, Jacob, and Herbert Taub. Pulse, Digital, and Switching Waveforms. McGraw-Hill Education, 1991.

<b>B.Tech.ECE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>II Year-II Semester</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **LINEAR AND DIGITAL IC APPLICATIONS**

**Prerequisites:** Switching Theory and Logic Design.

**Course Objectives:** The main objectives of the course are:

- To introduce the basic building blocks of linear integrated circuits.
- To introduce the theory and applications of analog multipliers and PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To understand and implement the working of basic digital circuits.

**Course Outcomes:** Upon completing this course, the student will be able to

- A thorough understanding of operational amplifiers with linear integrated circuits.
- Attain the knowledge of functional diagrams and design applications of IC555 and IC565.
- Acquire the knowledge and design the Data converters.
- Understanding of the different families of digital integrated circuits and their characteristics.

#### **UNIT-I: Operational Amplifier**

Ideal and Practical Op-Amp Characteristics, features of 741 Op- Amp, Modes of Operation -Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

#### **UNIT-II: Op-Amp, IC-555 & IC565 Applications**

Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and A stable Operations, Applications, IC565 PLL - Block Schematic, principle and Applications.

#### **UNIT-III: Data Converters**

Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

#### **UNIT- IV: Combinational Logic ICs**

Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary

Adder/Subtractor, Magnitude Comparators..

### **UNIT- V: Sequential Logic IC's and Memories**

Familiarity with commonly available 74XX & CMOS40XX Series ICs– All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

#### **Text Books:**

1. Op-Amps & Linear ICs– Ramakanth A. Gayakwad, PHI, 2003.
2. Digital Fundamentals –Floydand Jain, Pearson Education,8th Ed., 2005.

#### **Reference Books:**

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003.
2. Digital Design Principles and Practices–John. F. Wakerly, Pearson 3rd Ed., 2009.
3. Linear Integrated Circuits and Applications – Salivahana, TMH, 2008.
4. OperationalAmplifierswithLinearIntegratedCircuits,4th Ed., William D. Stanley, Pearson Education India, 2009.

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<b>II Year-II Semester</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COMPUTATIONAL MATHEMATICS LAB**  
(Using Python/MATLAB software)

**Prerequisites:** Matrices, Iterative methods and ordinary differential equations

**Course Objectives:** To learn

- Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
- Solution of Algebraic and Transcendental Equations using Python/MATLAB
- Solve problems of Linear system of equations
- Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.

**Course Outcomes:** After learning the contents of this paper, the student must be able to

- Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
- Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
- Write the code to solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients

**\* Visualize all solutions Graphically through programmes**

**UNIT - I: Eigen values and Eigen vectors:** **6P**

**Programs:**

- Finding real and complex Eigen values.
- Finding Eigen vectors.

**UNIT-II: Solution of Algebraic and Transcendental Equations** **6P**

Bisection method, Newton Raphson Method

**Programs:**

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

**UNIT- III: Linear system of equations** **6P**

Jacobi's iteration method and Gauss-Seidal iteration method

**Programs:**

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidal method

**UNIT-IV: First-Order ODEs** **8P**

Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

**Programs:**

- Solving exact and non-exact equations
- Solving exponential growth/decay and Newton's law of cooling problems

**UNIT-V: Higher order linear differential equations with constant coefficient 6P****Programs:**

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

**Text Books:**

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

**Reference Books:**

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

<b>B.Tech.ECE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>II Year-II Semester</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **ANALOG AND DIGITAL COMMUNICATIONS LAB**

#### **Course Outcomes:**

- Will be able to design and implement various Analog modulation and demodulation Techniques and observe the time and frequency domain characteristics of these modulated Signals
- Will be able to design and implement various Pulse modulation and demodulation Techniques and observe the time and frequency domain characteristics of these modulated Signals
- Will be able to understand the concept of aliasing and different types of Sampling with various Sampling rates and duty Cycles by implementing practically
- Will be able to design and implement various Digital modulation and demodulation Techniques and observe the waveforms of these modulated Signals practically
- Apply time division multiplexing concepts in different pulse modulation techniques.

#### **Note:**

- Minimum 12 experiments should be conducted.
- All these experiments are to be simulated first either using MATLAB, Commsim or any other simulation package and then to be realized in hardware.

#### **List of Experiments:**

1. Generate Amplitude modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
2. Generate Frequency modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
3. Generate modulated and demodulate DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically
4. Generate and demodulate SSB-SC modulated Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate theoretically and practically the modulation index in each case
5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting at least 4 different signals simultaneously with respect to time and recovering without distortion.

6. Verify Sampling theorem for different sampling rates, Sampling types and Duty Cycles and Plot the sampled and reconstructed Signals. Write the conclusions, based on practical observations
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
8. Design and implement a Pulse Width Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
9. Design and implement a Pulse Position Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations..
10. Generate PCM Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations
11. Generate Delta Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
12. Generate FSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
13. Generate practically Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate practically DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate practically QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot Signal Constellation for BPSK, BFSK and QPSK
17. Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram
18. Demonstrate ISI through eye diagram
19. Simulate raised cosine signal and duo binary signals
20. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
21. Analyze the performance of a Matched filter.

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### **ELECTRONIC CIRCUIT ANALYSIS LAB**

#### **Course Overview:**

The Electronic Circuit Analysis Laboratory is designed to provide hands-on experience in designing, building, and analyzing analog electronic circuits. It focuses on the practical implementation of amplifiers, oscillators, power amplifiers, multivibrators, and waveform generators using discrete components and simulation tools. The lab strengthens understanding of frequency response, gain, feedback, waveform shaping, and time base generation.

**Course Outcomes (COs):** Upon successful completion of this lab, students will be able to:

- Design and analyze multistage and power amplifiers and evaluate their frequency response and efficiency.
- Implement and examine feedback and oscillator circuits and validate theoretical conditions for sustained oscillations.
- Develop and interpret waveform generation circuits such as multivibrators and time base generators.
- Perform simulations to validate analog circuit performance using industry-standard software tools.
- Correlate practical results with theoretical predictions and identify deviations due to real-world constraints.

#### **List of Experiments:**

##### **A. Hardware Experiments (7):**

Perform practical design, implementation, and waveform analysis of amplifiers, oscillators, power stages, and multivibrators to validate theoretical concepts and observe real-world circuit behavior.

1. Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement and study coupling capacitance effects.
2. Design Hartley and Colpitts oscillators for a specified frequency and observe their output waveforms.
3. Design an RC phase shift oscillator and derive the practical gain condition for oscillations at a given frequency.
4. Design a transformer-coupled class A power amplifier, observe input/output waveforms, and calculate efficiency.
5. Design a class B power amplifier, analyze input/output waveforms, and evaluate harmonic distortion.
6. Design a bistable multivibrator, analyze commutating capacitor effects, and record transistor waveforms.
7. Design an astable multivibrator and observe transistor base and collector waveforms.

## **B. Software Simulations (7):**

Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:

1. Simulate four feedback amplifier topologies and compare their frequency responses with and without feedback.
2. Simulate a monostable multivibrator and analyze its input/output waveforms.
3. Simulate a Schmitt trigger for gain greater values than and less than one and analyze response behavior.
4. Simulate a bootstrap time base generator using BJT and observe the output sweep waveform.
5. Simulate a Miller sweep circuit using BJT and observe the time base output waveform.
6. Simulate a complementary symmetry push-pull amplifier and verify elimination of crossover distortion.
7. Simulate a single tuned amplifier and determine the quality factor (Q) of its tuned circuit.

### **Software Requirements:**

**Simulation Tools:** LTspice / Multisim / PSpice / Proteus / NI Multisim Live or equivalent

**Operating System:** Windows 10/11 or Linux (Ubuntu preferred)

### **Hardware Requirements:**

1. Dual Power Supply ( $\pm 15\text{V}$ , 0–30V)
2. Function Generator (up to 1 MHz)
3. CRO / DSO (Dual Channel, 20 MHz or more)
4. Digital Multimeters
5. Breadboards and Connecting Wires
6. BJTs: BC107, BC547, BC557, 2N2222, etc.
7. Resistors, Capacitors (Wide range of values)
8. Transformers (for power amplifiers)
9. Inductors, Crystals (1 MHz, 4 MHz, etc.)
10. Heat sinks, transistors for power stages (e.g., TIP41, TIP42 etc.)

**B.Tech.ECE****L T P C****II Year-II Semester****0 0 2 1****LINEAR AND DIGITAL IC APPLICATIONS LAB****Course Outcomes:**

- Design and implementation of various analog circuits using 741 ICs.
- Design and implementation of various Multivibrators using 555 timers
- Design and implement various circuits using digital ICs
- Design and implement ADC, DAC and voltage regulators.
- Design a Schmitt Trigger Circuit and find its LTP and UTP

**Note:**

- Minimum 12 experiments should be conducted.
- Verify the functionality of the IC in the given application.

**List of Experiments:**

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op-Amp and draw the comparison results of  $A=B$ ,  $A<B$ ,  $A>B$ .
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHz and find the roll off of it.
6. Design a Circuit using IC741 to generate sine / square / triangular wave with period of 1 KHz and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct A stable Multivibrator using IC 555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Frequency modulator and demodulator circuit and draw the respective waveforms.
11. Design Voltage Regulator using IC723, IC 7805 / 7809 / 7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type / counter type / successive approximation ADC and find its efficiency.
14. Design a Gray code converter and verify its truth table.
15. Design an even priority encoder using IC74xx and verify its truth table.
16. Design a 8x1 multiplexer using digital ICs.

17. Design a 4-bit Adder / Subtractor using digital ICs and Add / Sub the following bits.

(i) 1010	(ii) 0101	(iii) 1011
0100	0010	1001.

18. Design a Decade counter and verify its truth table and draw respective waveforms.

19. Design a Up/downcounter using IC74163 and draw read/write waveforms.

20. Design a Universal shift register using IC74194 / 195 and verify its shifting operation.

21. Design a 16x4 RAM using 74189 and draw its read /write operation.

22. Design a 8x3 encoder / 3x8 decoder and verify its truth table.

B.Tech.ECE

L T P C

II Year-II Semester

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**WEB AND MOBILE APPLICATIONS****Course Objectives:**

- Understand and apply core web technologies (HTML, CSS, JavaScript) for structured, styled, and interactive webpages.
- Build responsive websites using frameworks like Bootstrap and manage code using
- Git/GitHub.
- Create simple server-side functionality using Node.js and store/retrieve data from basic databases.
- Design and develop mobile applications using Flutter for Android and iOS.
- Integrate web and mobile development into a functional mini project with deployment..

**Week-by-Week Syllabus****Week 1: Introduction to the Web**

Understand web architecture, clients, servers, and workflows. Explore an existing website's structure and elements using browser DevTools.

**Week 2: HTML Basics** Learn about different markup languages and their significance.

Create a homepage for a static site using paragraphs, headings, lists, links, and images.

**Week 3: CSS – Layout & Design Foundations**

Apply colors, spacing, and layouts using CSS. Practice Flexbox and Grid techniques by cloning a simple website layout.

**Week 4: Introduction to JavaScript**

Understand the Document Object Model (DOM) and basic JavaScript constructs. Add interactivity to a webpage with a 'Contact Us' form that dynamically displays/hides details.

**Week 5: Combining HTML, CSS, and JavaScript**

Integrate skills from previous weeks to start building a personal portfolio website.

**Week 6: Responsive Design using Bootstrap**

Make your site adapt to different screen sizes (mobile, tablet, desktop) using Bootstrap's grid system and components.

**Week 7: Deployment using GitHub**

Learn version control basics with Git and GitHub. Publish your portfolio online via GitHub Pages and collaborate with classmates for code reviews.

**Week 8: Basic Server Concepts & Node.js**

Set up a basic Node.js server to serve web content. Understand server-side fundamentals and simple routing.

### **Week 9: Introduction to Databases**

Learn to store and retrieve data using JSON or SQLite. Save contact form submissions from your portfolio into a database.

### **Week 10: Introduction to Flutter**

Understand Flutter's widget structure and framework basics. Design a simple login and landing page for a mobile app.

### **Week 11: Mobile App Interactivity**

Create a Flutter app that displays a list of events. Add RSVP functionality with confirmation messages.

### **Week 12: Full-Stack Integration**

Build a registration page that saves new members to a database and displays a welcome message. Connect your Flutter app to a database for data-driven functionality.

### **Week 13: Project Work**

Apply all learned skills to build a real-world project such as a club/college event management application integrating both web and mobile interfaces.

### **Week 14: Final Presentations**

Present your completed project to classmates, highlighting key features, responsive design, and integration. Gather peer feedback for improvement.

### **Mini-Project Example Themes**

- Event registration & tracking for college clubs
- Simple inventory tracking system
- Student feedback & announcement portal
- IoT project dashboards (linking to electronics projects)

### **Reference Books:**

1. "Web Technologies: HTML, CSS, JavaScript" – Uttam K. Roy (Oxford University Press)
2. "Web Technology: Theory and Practice" – M.N. Rao & P.S. Rao (Pearson)
3. "Web Technologies: TCP/IP, Web/HTTP, Web Servers, Web Applications, and Cloud Computing" – Achyut S. Godbole & Atul Kahate (McGraw-Hill Education)
4. "Mobile Application Development" – Debasis Samanta & Goutam Kumar Panda (Prentice Hall India)
5. "Full Stack Web Development" – V. Srinivasa Rao (Notion Press).