

R-25
COURSE STRUCTURE
&
SYLLABUS

For the
II Year
Bachelor of Technology
(B. Tech)

With effect from the Academic Year 2025-26



VIDYA JYOTHI
INSTITUTE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

Accredited by NAAC, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)
Aziz Nagar Gate, C.B. Post, Hyderabad-500 075

Department of Electronics and Communication Engineering
(Accredited by NBA)



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Minutes of the 12th Board of studies meeting of ECE Department held on 22nd December 2025
at 02.00 PM in the online mode. Meeting Link: <https://meet.google.com/miv-bcrp-wia>

The following members are present:

S.No	Name of the BOS member	Designation	Role	Signature
1.	Dr. P. Nageswara Rao	Professor & Head ECE, VJIT	Chairman	
2.	Dr. K. Anitha Sheela	Professor, JNTUH UCETH	JNTUH Nominee	
3.	Dr. D. Rama Krishna	Professor of ECE, University College of Engineering, Osmania University, Hyd.	Academician, External	
4.	Dr. M. Kiran	Professor of ECE, Gokaraju Rangaraju Institute of Engineering and Technology, Hyd.	Academician, External	
5.	Dr. K. Sudharshan Reddy	Scientist E, DRDO, Hyd.	Industry Expert	
6.	Mr. P. Datta Ravi Teja	Senior Software Engineer, Mathworks, Hyd.	Alumni Member	
7.	Dr. M. Rajendra Prasad	Professor, ECE, VJIT	Internal Member	
8.	Dr. S. Thulasi Prasad	Professor, ECE, VJIT	Internal Member	
9.	Dr. P. Ganesan,	Professor, ECE, VJIT	Internal Member	
10.	Dr. M. Vadivel	Professor, ECE, VJIT	Internal Member	
11.	Dr. S. Pradeep Kumar Reddy	Associate Professor, ECE, VJIT	Internal Member	
12.	Dr. M. Krishnaiah	Assistant Professor, ECE, VJIT	Internal Member	
13.	Mrs. A. Jaya Lakshmi	Assistant Professor, ECE, VJIT	Internal Member	

HOD- ECE, chairman BOS
(Dr. P. Nageswara Rao).



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9.	Dr. P. Ganesan,	Professor, ECE, VJIT	Internal Member	
10.	Dr. M. Vadivel	Professor, ECE, VJIT	Internal Member	
11.	Dr. S. Pradeep Kumar Reddy	Associate Professor, ECE, VJIT	Internal Member	
12.	Dr. M. Krishnaiah	Assistant Professor, ECE, VJIT	Internal Member	
13.	Mrs. A. Jaya Lakshmi	Assistant Professor, ECE, VJIT	Internal Member	

(Dr. P. Nageswara Rao)
HOD-ECE, chairman-BOS



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Agenda for the Board of Studies Meeting

1. Welcome and Opening remarks by the Chairperson
2. Discussion and approval of course structure for 2nd year B.Tech (ECE) under R25 regulations.
3. Discussion and approval of detailed syllabus for 2nd year B.Tech (ECE) under R25 regulations.
4. Discussion and approval of three courses related to EEE department offered by ECE:
 - a. Digital Electronics
 - b. Digital Electronics Lab
 - c. PCB Design.
5. Discussion and approval of Minor Degree, which commences from II-II including detailed syllabus and course structure, to be aligned and updated subsequent to the release of JNTUH guidelines on Minor Degree program structure and syllabus under R25.
6. Any other item with the permission of the Chair.

CHAIRMAN
Board of Studies, Dept. of ECE



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Department of Electronics and Communication Engineering
(Accredited by NBA)

Date: 22-12-2025

MINUTES OF MEETING

RESOLUTION

Item No. 1: Discussion & Approval of II B.Tech ECE Course Structure (R-25)

The chairman of BoS presented a detailed course structure of II B.Tech. ECE R-25 regulations.

Resolution (1): The members after a detailed discussion approved the course structure of B.Tech II year ECE of R-25 regulations. The details of the course structure are given in Annexure – I

Noted and Approved.

Item No. 2: Discussion & Approval of syllabus of II B.Tech ECE courses in R-25 regulations

The chairman of BoS presented detailed syllabi of B.Tech II Year courses offered by ECE Department to ECE branch in R-25 regulations.

Resolution (2): The members after thorough discussion approved the syllabi of B.Tech II Year of ECE branch. The detailed approved syllabus is given in Annexure -2

1. The External BoS Members suggested to remove *point conditioning and transformations of multiple Random variables* from PTSP course Unit-III as the syllabus is too heavy for the students and also suggested to keep the *Ergodic, correlation ergodic and Poisson random process* definitions so that the student can know the topics which are useful for Machine learning and AI related subjects.
2. In Signals and Systems course *Correlation, Energy and power density spectrum relation and parseval's theorem* topics are removed as they are covered in properties of Fourier Transforms and members approved the said change.
3. In Electronic Devices and Circuits course, *FET amplifiers* topic is added in unit-IV, since the members emphasized the importance of the topic and same is approved.
4. In EMTL course, *Reflection and Refraction of Plane Waves — Normal and Oblique Incidences for Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection* are removed and the members approved the deletion.
5. In Analog and Digital Communication course BoS members suggested to include *optimum receivers, coherent detection, and Base band shaping for data transmission* as these topics are useful for digital communication.

Noted and Approved.



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Item No. 3: Discussion & Approval of syllabus of II B.Tech EEE courses in R-25 regulations offered by ECE Department.

The chairman of BoS presented detailed syllabi of B.Tech II Year courses offered by ECE Department to EEE branch in R-25 regulations.

Resolution (2): The members after thorough discussion approved the syllabi of B.Tech II Year of EEE branch offered by ECE Department. The detailed approved syllabus is given in Annexure -3

Noted and Approved

Item No 4: The members suggested that the finalization of the course structure and detailed syllabus of minor degree offered by ECE department should be taken up only after the University releases the official guidelines.

The chairman of BoS quoted about minor degree commencement from II-II instead of III-I as per the university regulations.

Noted

Signature of the BOS Member

1. Dr. P. Nageswara Rao

2. Dr. K. Anitha Sheela

3. Dr. D. Rama Krishna

4. Dr. M. Kiran

5. Dr. K. Sudharshan Reddy

6. Mr. P. Datta Ravi Teja

7. Dr. M. Rajendra Prasad

8. Dr. S. Thulasi Prasad

9. Dr. P. Ganesan,

10. Dr. M. Vadivel

11. Dr. S. Pradeep Kumar Reddy

12. Dr. M. Krishnaiah

13. Mrs. A. Jaya Lakshmi



I-I

S. No	Course Code	Course Title	L	T	P	Credits
1	A251002	Mathematics-I (Matrices & Calculus)	3	1	0	4.0
2	A251003	Advanced Engineering Physics	3	0	0	3.0
3	A251503	Programming for Problem Solving	3	0	0	3.0
4	A251201	Basic Electrical Engineering	2	0	0	2.0
5	A251001	English for Skill enhancement	3	0	0	3.0
6	A251082	Advanced Engineering Physics Lab	0	0	2	1.0
7	A251583	Programming for Problem Solving Lab	0	0	2	1.0
8	A251081	English Language & Communication Skills Lab	0	0	2	1.0
9	A251281	Basic Electrical Engineering Lab	0	0	2	1.0
		Induction Program				
Total			14	01	08	19

I-II

S. No	Course Code	Course Title	L	T	P	Credits
1	A252002	Mathematics – II (Ordinary Differential Equations & Vector Calculus)	3	0	0	3.0
2	A252004	Engineering Chemistry	3	0	0	3.0
3	A252502	Data Structures Essentials	3	0	0	3.0
4	A252503	Python Programming	3	0	0	3.0
5	A252402	Network Analysis & Synthesis	3	0	0	3.0
	A252381	Engineering Work Shop	0	0	2	1.0
6	A252302	Engineering Drawing and Computer Aided Drafting	2	0	2	3.0
7	A252083	Engineering Chemistry Lab	0	0	2	1.0
8	A252582	Data Structures Essentials Lab	0	0	2	1.0
9	A252584	Applied Python programming Lab	0	0	2	1.0
Total			17	0	10	22

1.	2.	3.	4.	5.	6.	7.
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II-I

S. No	Course Code	Course Title	L	T	P	Credits
1		Probability Theory and Stochastic Processes	3	0	0	3
2		Signals and Systems	3	0	0	3
3		Electronic Devices and Circuits	3	0	0	3
4		Digital Logic Design	3	0	0	3
5		Control Systems Engineering	2	0	0	2
6		Innovation and Entrepreneurship	2	0	0	2
7		Modelling and Simulation Lab	0	0	2	1
8		Electronic Devices and Circuits Lab	0	0	2	1
9		Digital Logic Design Lab	0	0	2	1
10		Linux and Shell Scripting	0	0	2	1
11		Environmental Science	1	0	0	1
			17	0	8	21

II-II

S. No	Course Code	Course Title	L	T	P	Credits
1		Numerical Methods and Complex Variables	3	0	0	3
2		Electromagnetic Fields and Transmission Lines	3	0	0	3
3		Analog and Digital Communications	3	0	0	3
4		Electronic Circuit Analysis	3	0	0	3
5		Linear and Digital IC Applications	3	0	0	3
6		Computational Mathematics Lab	0	0	2	1
7		Analog and Digital Communications Lab	0	0	2	1
8		Electronic Circuit Analysis Lab	0	0	2	1
9		Linear and Digital IC Applications Lab	0	0	2	1
10		Web and Mobile Applications	0	0	2	1
			15	0	10	20

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PROBABILITY THEORY AND STOCHASTIC PROCESSES

II B.Tech I Semester (ECE)

L	T	P	C
3	0	0	3

Pre-requisite: Mathematics

Course Objectives:

1. Understand the concept of random variable and its classification
2. Comprehend the significance of distribution and density functions of random variable.
3. Interpret the principle of joint random variables and computation of their statistical parameters.
4. Realize the concept of a random process and its analysis in both time and frequency domain.
5. Understand the effect of an LTI system on its random excitation and Noise

Course Outcomes:

After going through this course the student can

1. Determine the applications of various random variables based on individual Cumulative Distribution Function and Probability Density Function.
2. Compute the various statistical averages of single/multiple random variables and enumerate their significance.
3. Analyze a random variable as a function of time, with reference to its temporal and spectral characteristics.
4. Determine the effect of an LTI system on the time domain and frequency domain characteristics of the random excitation.
5. Analyze a noise in various basic Electrical and Communication System

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	3	-
CO3	3	3	3	2	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	-	-	-	-	-	-	-	3	-
CO5	3	3	3	3								3	-

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.

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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, 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 and Density Functions, Conditional Distribution and Density Functions, 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.

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 Stationary, Definitions of The 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, Basic Definitions of Narrow Band noise , Quadrature representation of narrow band noise.

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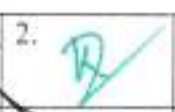
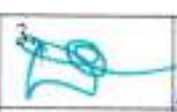
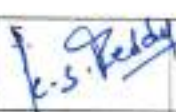
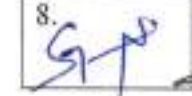
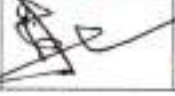


TEXT BOOKS:

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. Unnikrishna 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
5. Y Mallikarjuna Reddy - Probability Theory and Stochastic Processes, 4th Edition, University Press

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SIGNALS AND SYSTEMS

II B.Tech I Semester (ECE)

L	T	P	C
3	0	0	3

Pre-requisite: Mathematics

Course Objectives:

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

Course Outcomes:

After going through this course the student can

1. Analyze and classify signals and systems using vector space concepts, orthogonality, and standard signal representations.
2. Represent and analyze continuous-time signals using Fourier series and Fourier Transform techniques.
3. Analyze signal transmission through linear systems using convolution, transfer functions, and bandwidth concepts.
4. Apply Laplace Transform and correlation techniques to analyze continuous-time signals and systems.
5. Apply sampling theorem and Z-Transform techniques for analysis of continuous-time and discrete-time signals.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	1	–	–	–	–	–	–	–	3	–
CO2	3	3	2	2	–	–	–	–	–	–	–	3	–
CO3	3	3	2	1	–	–	–	–	–	–	–	3	–
CO4	3	3	3	2	–	–	–	–	–	–	–	3	–
CO5	3	3	2	2	–	–	–	–	–	–	–	3	–

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

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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. 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 rise time.

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

UNIT – V

Sampling theorem: Graphical and analytical proof of Sampling Theorem for Base band/Band Limited Signals 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. Lathi B P, Signals, Systems & Communications, B.S. Publications, 2003.
2. Alan V. Oppenheim, Alan S. Willsky, Syed Hamid Nawab , Signals and Systems, Prentice Hall India, 1997

REFERENCE BOOKS:

1. Simon S. Haykin, Barry Van Veen , Signals and Systems, Wiley, 2003
2. Rama Krishna Rao A, Signals and Systems, 2008, Tata McGraw Hill, 2008.

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ELECTRONIC DEVICES AND CIRCUITS
(Common for ECE & EEE)

II B.Tech I Semester

L	T	P	C
3	0	0	3

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 FinFETs and CNTFETs. Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics.

Course Outcomes:

After going through this course the student can

1. Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits.
2. Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) & Field Effect Transistors and analyze their input and output characteristics.
3. Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications.
4. Analyze transistor amplifier circuits using small signal models and assess performance for various configurations.
5. Analyze the structure and working of Special purpose diodes and advanced devices like FinFETs and CNTFETs

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	-	-	2	-
CO2	3	3	2	2	1	-	-	-	-	-	-	2	1
CO3	3	3	3	2	1	-	-	-	-	-	-	2	2
CO4	3	3	3	2	2	-	-	-	-	-	1	2	-
CO5	3	3	2	2	2	1	-	-	-	-	2	2	2

UNIT - I:

Diode Characteristics and Applications: PN junction diode – V-I 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 – V-I 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

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(CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

Field Effect Transistors (FET): JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes — Structure, operation and 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 h parameter model for CE amplifier.

FET Amplifiers: FET Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers.

UNIT - V:

Special Purpose Diodes: Principle of Operation of - SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode.

Advanced Devices: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET.

TEXT BOOKS:

1. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. Pearson, 11th ed., 2013.
2. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. Tata McGraw-Hill, 1991.
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.

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DIGITAL LOGIC DESIGN

II B.Tech I Semester (ECE)

L	T	P	C
3	0	0	3

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:

After going through this course the student can

1. Apply number systems, codes, and logic gates in digital system design
2. Minimize Boolean functions using K-maps and implement using logic gates.
3. Design and analyze combinational logic circuits.
4. Design and analyze sequential logic circuits.
5. Analyze Moore and Mealy machines and explain memory & PLDs.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	1	-	1
CO2	3	3	3	2	2	-	-	-	-	-	1	-	2
CO3	3	3	3	2	2	-	-	-	-	-	1	-	3
CO4	3	3	3	2	2	-	-	-	-	-	1	-	3
CO5	3	2	3	2	3	-	-	-	-	-	2	-	3

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.

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UNIT-IV:

Sequential Logic Circuits: Gated latches, Flip-flops: Clocked S-R, D, T, JK, Master-Slave JK, Flip-Flop Conversions, 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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CONTROL SYSTEMS

II B.Tech I Semester (ECE)

L	T	P	C
2	0	0	2

Pre-Requisites:

Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus
Laplace Transforms, Numerical Methods and Complex variables

Course Objectives:

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

Course Outcomes:

After going through this course the student can

1. Describe open- and closed-loop systems, and develop mathematical models using block diagrams and signal flow graphs.
2. Analyze the time-domain response of control systems, evaluate transient and steady-state performance, and apply PID controllers to improve system behavior.
3. Determine the stability of control system using Routh-Hurwitz Criterion and root locus technique and assess the effects of poles and zeros on system performance.
4. Analyse frequency response plots including Bode, Polar, and Nyquist plots and investigate system stability.
5. Apply the state-variable approach and analyze controllability and observability.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	2	1
CO2	3	3	2	1	1	-	-	-	-	-	-	2	1
CO3	3	3	2	1	1	-	-	-	-	-	-	2	-
CO4	3	3	3	2	1	-	-	-	-	-	-	2	-
CO5	3	3	2	1	1	-	-	-	-	-	-	2	2

UNIT - I

Control System fundamentals: Classification of control systems, Open and Closed loop systems, Mathematical modelling of Translational and Rotational mechanical systems, Block diagram reduction and Signal flow graphs.

1.	2.	3.	4.	5.	6.
8.	9.	10.	11.	12.	13.



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, Effects of proportional derivative, proportional integral systems and PID controllers, Application of Proportional, Integral and Derivative Controllers.

UNIT - III

Stability analysis in S- Domain:

The concept of stability – Routh's stability criterion – qualitative stability & conditional stability – limitations of Routh's stability.

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

Compensation techniques: Types of Compensation, Introduction to phase Lag, Lead and Lead-Lag Compensators.

UNIT - V

State space representation: Concept of state and state variables. State models of linear time invariant systems, Derivation of State model from transfer function, Derivation of transfer function from State model, State transition matrix and it's Properties, Controllability and observability.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009.
2. Nagoor kani A, Control Systems Engineering, CBS PUB & DIST, 2020

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.

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MODELLING & SIMULATION LAB

II B.Tech I Semester (ECE)

L	T	P	C
0	0	2	1

Note:

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

Course Outcomes:

After going through this course the student

- 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
- Analyze their Characteristics by finding different higher order Moments and noise removal applications.
- Will be able to use a Simulink for Control System applications

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	3	3	2	-	-	3	1	-	3	-
CO2	3	2	3	3	3	2	-	-	3	1	-	3	-
CO3	3	2	3	3	3	2	-	-	3	1	-	3	-
CO4	3	2	3	3	3	2	-	-	3	1	-	3	-
CO5	3	2	3	3	3	2	-	-	3	1	-	3	-

List of Experiments:

Signals and Systems (Minimum 7 Experiments)

- Write the code / script for generating various standard viz: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sine.
- Perform different operations viz: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.
- Write the code / script for finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal.
- Write the code / script for finding the output of a System for a given input and Impulse Response.
- Write the code / script for finding Auto Correlation and Cross Correlation of Signals /

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sequences

6. Write the code / script for Verifying whether a given Continuous/Discrete System is Linear, Time Invariant.
7. 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
8. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Fourier Transform.
9. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Laplace Transform. Also plot pole-zero diagram in S-plane.
10. Write the code/ script for finding and plotting the Magnitude and Phase Spectrum of any given Sequence by finding its Z-Transform. Also plot pole — zero diagram in Z-plane.
11. Gibbs Phenomenon.

Probability Theory and Stochastic Processes (Any 3 Experiments)

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

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>

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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

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

(Common for ECE & EEE)

II B.Tech I Semester

L	T	P	C
0	0	2	1

Note:

- Minimum of 12 experiments are to be completed.

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:

After completing this course, students will be able to:

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

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	-
CO2	3	3	3	2	1	1	-	-	-	-	-	2	-
CO3	3	3	2	2	1	-	-	-	-	-	-	2	-
CO4	3	3	3	2	1	-	-	-	-	-	1	3	-
CO5	2	2	2	3	3	-	-	-	-	-	2	2	-

List of Experiments:

A. Hardware-Based Experiments (7):

- Plot the V-I characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
- Plot the V-I characteristics of a Zener in forward and reverse bias to determine cut-in voltage and break down voltage.
- Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.

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4. Design and analyze half-wave with and without capacitor filters to evaluate ripple factor and output voltage.
5. Design and analyze full-wave rectifiers (center-tap) with and without capacitor filters to evaluate ripple factor and output voltage.
6. Plot the input and output characteristics of a BJT in common emitter configuration to determine the value of h parameters.
7. Design and test voltage divider bias circuit to establish a stable operating point for a BJT amplifier and draw the DC load line behavior.

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 the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and transconductance.
4. Simulate a common emitter amplifier to analyze the effect on voltage gain and signal amplification.
5. Simulate a common source amplifier to analyze the effect on voltage gain and signal amplification.
6. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
7. Design and simulate a CMOS inverter to study digital switching behavior and low-power logic design.

Hardware Requirements:

1. Regulated DC Power Supply (0-30 V)
2. Function Generators
3. Digital Multimeter
4. Cathode Ray oscilloscope or DSO
5. Breadboards and connecting wires
6. Resistors, Capacitors Diodes
7. BJTs, JFETs, and MOSFETS
8. Trainer kits (optional)

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. PSICE for TI or OrCAD Lite
6. Windows PC

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DIGITAL LOGIC DESIGN LAB

II B.Tech I Semester (ECE)

L	T	P	C
0	0	2	1

Note:

- Minimum of 12 experiments are to be completed.

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:

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.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	1	3	1
CO2	3	3	3	2	2	-	-	-	-	-	1	3	1
CO3	3	3	3	2	3	-	-	-	-	-	2	3	2
CO4	2	2	2	3	3	-	-	-	-	-	2	2	3
CO5	3	3	3	2	3	-	-	-	-	-	2	2	3

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.

- Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.

1.	2.	3.	4.	5.	6.	7.
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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 7-segment decoder logic.

B. VerilogHDL-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 data flow modeling; extend it to 4-bit using structural modeling.
2. Implement a 2:1 multiplexer using data flow modeling and design an 8:1 multiplexer using structural modeling.
3. Design a 2-to-4 decoder using data flow 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 behavioural 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 behavioural modeling.

Required Hardware (for Hardware Lab Experiments)

Component	Description
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

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8.	9.	10.	11.	12.	13.	



Required Software Tools (for Verilog HDL Experiments) (Any one of the tools given below)

Software	Purpose
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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8.	9.	10.	11.	12.	13.	



ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

II B.Tech II Semester (ECE)

L	T	P	C
3	0	0	3

Pre-requisite: Mathematics

Course Objectives:

1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields and apply them to solve engineering problems.
2. 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.
3. To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
4. To analyze the propagation of waves in transmission line and able to solve transmission line problem using Smith Chart.

Course Outcomes:

After going through this course the student will be able to

1. Apply electrostatic principles to analyze electric fields, potentials for various charge distributions and boundary conditions.
2. Analyze magnetostatic fields and forces using Biot-Savart's law, Ampere's law and magnetic potentials for steady current systems.
3. Apply Maxwell's equations to analyze time-varying electromagnetic fields and evaluate electric and magnetic boundary conditions at material interfaces
4. Analyze electromagnetic wave propagation and reflection-refraction characteristics in conducting and dielectric media
5. Evaluate and compare transmission line performance, reflections, and impedance matching techniques using analytical methods and Smith Chart.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	2

UNIT I – Electrostatics

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,

1.	2.	3.	4.	5.	6.	7.
8.	9.	10.	11.	12.	13.	



Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors-Parallel Plate, Coaxial, Spherical.

UNIT II - Magnetostatics

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.

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.

TEXT BOOKS:

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

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 Huseyin R. Hiziroglu, Cambridge University Press, 2nd Ed., 2006

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ANALOG AND DIGITAL COMMUNICATIONS

II B.Tech II Semester (ECE)

L	T	P	C
3	0	0	3

Pre-requisite: Signals and Systems

Course Objectives:

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

Course Outcomes:

After going through this course the student will be able to

1. Analyse AM, DSB-SC, SSB, FM and PM techniques and explain their generation and detection in time and frequency domains.
2. Explain the operation and performance of AM/FM transmitters and receivers, including superheterodyne and FM systems under noise.
3. Apply pulse modulation, detection and baseband shaping concepts to analyze signal detection in noise and intersymbol interference.
4. Analyse digital modulation schemes and evaluate their bandwidth efficiency, power spectra and noise performance.
5. Apply information theory to evaluate channel capacity and design efficient source and channel coding schemes.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	–	–	–	–	–	–	2	1
CO2	3	2	1	2	1	–	–	–	–	–	–	1	1
CO3	3	3	2	2	2	–	–	–	–	1	–	3	1
CO4	3	3	3	2	2	–	–	–	–	–	–	3	2
CO5	3	3	2	1	1	–	–	–	–	–	–	2	1

UNIT – I

Amplitude Modulation

Need for modulation, amplitude modulation: time and frequency domain description, generation using switching modulator, detection using envelope detector, DSB-SC modulation: generation using balanced modulator, detection using synchronous detector, COSTAS loop, SSB modulation: time and frequency domain description, generation using phase discrimination method and demodulation using coherent detection, vestigial sideband modulation and demodulation.

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Angle Modulation

Basic concepts of phase modulation, frequency modulation: single-tone frequency modulation, spectrum analysis, Carson's rule, generation of FM waves using Armstrong method, detection of FM waves using phase-locked loop, comparison of FM and AM.

UNIT – II

Transmitters & Receivers

Classification of transmitters, AM transmitters, FM transmitters, AM receiver – superheterodyne receiver, FM receivers, stereo FM multiplex reception, comparison of AM and FM receivers, noise analysis in AM, DSB, SSB and FM modulation systems, threshold effect in angle modulation systems, pre-emphasis and de-emphasis.

UNIT – III

Pulse Modulation

Pulse modulation techniques including PAM, PWM and PPM, and a comparison of FDM and TDM.

Detection and Estimation

Detection of signals in noise, probability of error, optimum coherent receivers including matched filter and correlation receivers and detection of signals with unknown phase.

Baseband Shaping for Data Transmission

Line encoding requirements, unipolar, polar and bipolar line coding, discrete PAM signalling, inter symbol interference, Nyquist criterion, Duobinary signalling, and 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 systems.

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, and constellation diagrams.

UNIT – V

Information Theory and Coding

Entropy, information rate, mutual information, channel capacity of discrete channels, 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, PHI, 2009

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2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019
3. Principles of Communication Systems – Herbert Taub, Donald L. Schilling, Goutam Saha, McGraw-Hill, 2008

REFERENCES

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

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ELECTRONIC CIRCUIT ANALYSIS

II B.Tech II Semester (ECE)

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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 multivibrators. 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:

After going through this course the student will be able to

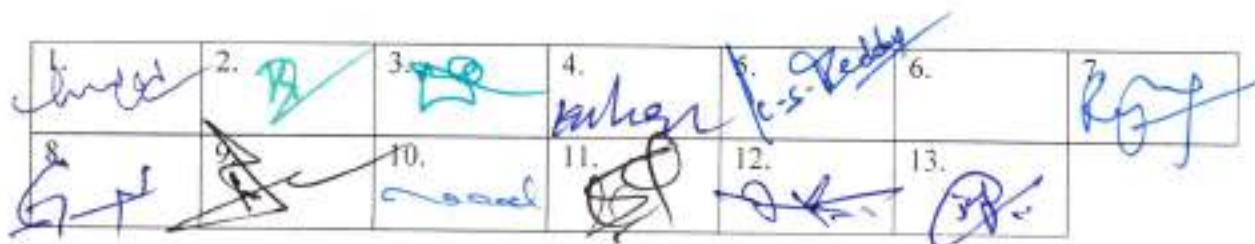
1. Analyze and classify multistage amplifier configurations also apply the hybrid- π transistor model to evaluate high-frequency behavior of common-emitter amplifiers.
2. Examine feedback amplifier types and assess the influence of negative feedback on gain stability, bandwidth, and distortion.
3. Design and analyze LC, RC, and crystal oscillators based on the Barkhausen criterion to generate sinusoidal waveforms
4. Design and evaluate the performance analyze of power amplifiers and tuned amplifiers
5. Design and generate output waveforms of multivibrator circuits.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	1	0	0	0	0	0	3	1
CO2	3	3	3	2	2	0	0	0	0	0	1	3	1
CO3	3	3	3	2	2	1	0	0	0	0	1	3	2
CO4	3	3	3	2	2	0	0	0	0	0	1	2	3
CO5	3	3	3	2	2	1	0	0	0	0	1	2	2

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 amplifier, Cascode amplifier and Darlington pair amplifier.

High-Frequency Transistor Model: Hybrid- π model, Hybrid- π parameters: Conductances and capacitances, CE short-circuit current gain, 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:

Oscillators: 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 Crossover distortion.

Tuned Amplifiers: Introduction, single Tuned capacitive coupled Amplifier – Q factor, frequency response, Concept of stagger tuning amplifier.

UNIT - V:

Multivibrators: Analysis and design of Bistable, Monostable and Astable multivibrators 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.

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LINEAR AND DIGITAL IC APPLICATIONS

II B.Tech II Semester (ECE)

L	T	P	C
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Course Objectives: The main objectives of the course are:

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

Course Outcomes:

After going through this course the student will be able to

1. Explain the characteristics and functioning of ideal and practical operational amplifiers and analyze op-amp-based circuits and voltage regulators for analog applications.
2. Analyze and design active filter circuits, waveform generators using operational amplifiers, IC 555 timer, and IC 565 PLL for signal processing applications.
3. Acquire the knowledge and design the Data converters.
4. Apply TTL 74XX and CMOS 40XX series ICs to analyze and implement combinational logic circuits.
5. Apply 74XX series ICs to analyze and implement sequential logic circuits

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	-	-	-	1	-	-	-	3	2
CO2	3	3	3	1	-	-	-	1	-	-	-	3	2
CO3	3	3	3	1	-	-	-	1	-	-	-	3	2
CO4	3	3	3	2	-	-	-	1	-	-	-	3	3
CO5	3	3	3	2	-	-	-	1	-	-	-	3	3

UNIT - I

Operational Amplifier

Introduction to IC's-advantages, Ideal and Practical Op-Amp Characteristics, Features of 741 Op- Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Sample & hold Circuit, Differentiators and Integrators, Comparators, Schmitt Trigger, Voltage Regulators- Three Terminal Voltage Regulators, Features of IC 723,

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,

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Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable 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- Binary to Gray, Gray to Binary, BCD to Excess-3, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Parity Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic IC's

Familiarity with commonly available 74XX & CMOS40XX Series ICs- All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers and Types.

TEXT BOOKS

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

REFERENCE BOOKS

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

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ANALOG AND DIGITAL COMMUNICATIONS LAB

II B.Tech II Semester (ECE)

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Note:

- Minimum 12 experiments should be conducted.
- All these experiments are to be simulated either using MATLAB, Commsim or any other simulation package.

Course Outcomes:

After going through this course the student will be able to

1. Apply analog communication principles to generate, demodulate, and analyze AM, FM, DSB-SC, and SSB-SC signals in time and frequency domains.
2. Implement and analyze multiplexing and sampling techniques, including FDM and sampling theorem verification, using practical observations.
3. Design and realize pulse modulation systems (PAM, PWM, PPM, PCM, and Delta modulation) using hardware and simulation tools.
4. Generate and evaluate digital modulation schemes (FSK, BPSK, DPSK, QPSK) and analyze constellation diagrams under noise.
5. Analyze advanced digital communication concepts such as ISI, eye diagrams, pulse shaping, source coding, and matched filter performance.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	-	3	1	2	2	-	2	3	2	-	3	2
CO2	1	-	3	1	2	2	-	2	3	2	-	3	2
CO3	1	-	3	1	2	2	-	2	3	2	-	2	1
CO4	1	-	3	1	2	2	-	2	3	2	-	3	2
CO5	1	-	3	1	2	2	-	2	3	2	-	3	2

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

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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

II B.Tech II Semester (ECE)

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Note:

- Minimum 12 experiments should be conducted.

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:

After going through this course the student will be able to

- Design and analyze multistage amplifier and evaluate their frequency response.
- Design and analyze feedback & power amplifiers and evaluate their frequency response.
- Develop and interpret waveform generation circuits such as oscillators, 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.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	1	-	-	-	-	-	3	1
CO2	3	3	3	2	2	1	-	-	-	-	-	3	2
CO3	3	3	3	2	1	-	-	-	-	-	-	3	1
CO4	2	2	3	3	3	-	-	-	-	-	1	2	2
CO5	3	3	2	3	2	1	-	-	-	-	1	2	2

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.

- Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement.
- Design Hartley oscillator for a specified frequency and observe their output

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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 Push Pull power amplifier, analyze input/output waveforms and calculate its efficiency.
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):

Use circuit simulation software to design, analyze, and verify the performance of feedback amplifiers, waveform generators, and power amplifier circuits through virtual experimentation and frequency response evaluation.

1. Simulate voltage series/voltage shunt 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 values greater 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 ($\pm 15V$, 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)

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LINEAR AND DIGITAL IC APPLICATIONS LAB

II B.Tech II Semester (ECE)

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Note:

- Minimum 12 experiments should be conducted.

Course Outcomes:

After going through this course the student will be able to

1. Design and implementation of various analog circuits using IC 741.
2. Design and Implementation of Various Multivibrators Using 555 timer.
3. Design and implement low pass and High pass filters and DAC using IC 741.
4. Design and implement various combinational circuits using digital ICs.
5. Design and implement various sequential circuits using digital ICs.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	-	-	-	3	3	3	-	2	1
CO2	3	3	2	1	-	-	-	3	3	3	-	2	1
CO3	3	3	2	1	-	-	-	3	3	3	-	2	1
CO4	3	3	2	1	-	-	-	3	3	3	-	-	3
CO5	3	3	2	-	-	-	-	3	-	-	-	-	3

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 inverting Comparator with positive/negative/zero reference voltages using Op-Amp
4. Design first order Active LPF, HPF using Op-Amp
5. Design a Circuit using IC741 to generate square wave and draw the output waveform.
6. Design a Circuit using IC741 to generate triangle wave and draw the output waveform
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct Astable Multivibrator using IC555 and draw its output waveform and also find its duty cycle..
9. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.

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10. Design a 4-bit binary to Gray code converter and verify its truth table.
11. Verify the truth table of priority encoder using IC 74148
12. Design 4-bit function using 8x1 multiplexer digital IC 74138.
13. Design a 4-bit Adder/ Subtractor using digital ICs and Add/Sub the following bits.
(i)1010 (ii)0101 iii)1011
0100 0010 1001
14. Verify the truth table of Decade counter using IC 7490
15. Verify the truth table of Up/down counter using IC74163
16. Verify the functionality of Universal shift register using IC74194/195
17. Verify the truth table magnitude comparator IC 7485

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DIGITAL ELECTRONICS

II B.Tech II Semester (EEE)

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Pre-requisite: Electronic Devices and Circuits

Course Objectives:

1. To learn fundamental concepts of digital system design and common forms of number representations and their conversions.
2. To implement and design logical operations using combinational logic circuits and sequential logic circuits.
3. To understand the semiconductor memories and programmable logic devices.

Course Outcomes:

After going through this course the student can

1. Explain the fundamentals of digital systems, logic families, Boolean algebra, and number systems used in digital circuit analysis.
2. Apply Karnaugh map techniques to simplify and minimize combinational logic functions including multiplexers and demultiplexers.
3. Analyze combinational circuits such as adders, subtractors, comparators, encoders, decoders, and code converters for functional correctness.
4. Evaluate the behavior and performance of sequential circuits including flip-flops, shift registers, and synchronous and asynchronous counters.
5. Design digital systems using semiconductor memories and programmable logic devices such as ROM, RAM, PLA, PAL, and FPGA.

UNIT - I:

Fundamentals of Digital Systems and Logic Families: Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, Examples of IC gates, Number systems-binary, Signed binary, Octal hexadecimal number, Binary arithmetic, One's and Two's complements arithmetic.

UNIT - II:

Combinational Circuits-I: Standard representation for logic functions, K-map representation and simplification of logic functions using K- map, Minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer

UNIT - III:

Combinational Circuits-II: Adders, Subtractors, Carry look ahead adder, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/Drivers for display devices.

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UNIT - IV:

Sequential Circuits: Introduction to flip-flops, SR, JK, T and D type's flip-flops, Shift registers, Conversion of flip-flops, Ring counter, Ripple (Asynchronous) counters, Synchronous counters.

UNIT - V:

Semiconductor Memories and Programmable Logic Devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read-only memory (ROM), ROM types, Read and write memory (RAM) types, Programmable logic array, Programmable array logic, Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOKS:

1. R.S. Sedha, "A Textbook of Digital Electronics", S. Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

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DIGITAL ELECTRONICS LAB

II B.Tech II Semester (EEE)

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Pre-requisite: Analog Electronics & Digital Electronics

Course Objectives:

1. To learn basic techniques for the design of digital circuits and number conversion systems.
2. To implement simple logical operations using combinational logic circuits.
3. To design combinational logic circuits, sequential logic circuits.

Course Outcomes:

After going through this course the student can

1. Set up and verify basic digital logic functions by realizing Boolean expressions, logic gates, and truth/excitation tables using standard logic families.
2. Implement combinational logic circuits such as adders/subtractors, code converters, multiplexers, and comparators using logic gates and universal gates.
3. Generate and test timing and sequencing circuits including clock generators, pseudo-random sequence generators, and shift registers using logic gates and flip-flops.
4. Analyze sequential circuits such as synchronous and asynchronous counters by correctly interconnecting and triggering flip-flops.
5. Realize integrated digital subsystems by selecting appropriate logic families and validating their functional performance through experimental verification.

Any 10 experiments are required to be conducted:

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND/NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of a 4-bit pseudo random sequence generator using logic gates.
7. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
8. Design and realization Asynchronous and Synchronous counters using flip-flops
9. Design and realization 8x1 using 2x1 mux
10. Design and realization 2-bit comparator
11. Verification of truth tables and excitation tables
12. Realization of logic gates using DTL, TTL, ECL, etc.,

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOKS:

1. R.S. Sedha, "A Textbook of Digital Electronics", S.Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

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PCB DESIGN

II B.Tech II Semester (EEE)

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Pre-requisite: Analog Electronics & Digital Electronics

Course Objectives:

1. To understand the basics of PCB types, materials, and design standards.
2. To gain hands-on experience with PCB layout software tools.
3. To develop skills in schematic capture, component placement, routing, and Gerber generation.
4. To fabricate and test a simple single-layer PCB.

Course Outcomes:

After going through this course the student can

1. Explain the design and fabrication process of PCBs.
2. Design schematic diagrams and convert them to PCB layouts.
3. Apply routing and layout techniques using EDA tools.
4. Generate Gerber files and perform DRC/ERC effectively.
5. Troubleshoot the errors of the circuits and correct them

Module I: Fundamentals of PCB Design

- Types of PCBs: Single-layer, Double-layer, Multilayer
- PCB materials and manufacturing process
- PCB design rules and standards (IPC standards)
- Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity:

- Exploring the user interface of PCB design software
- Setting up design rules

Module II: Schematic Design

- Creating circuit schematics using PCB CAD tools
- Component library management
- Electrical rule checking (ERC)
- Netlist generation

Lab Activity:

- Designing a basic power supply or LED flasher circuit
- Performing ERC and generating netlist

Module III: PCB Layout and Routing

- Importing netlist to layout editor
- Footprint assignment and component placement
- Manual vs auto-routing
- Design Rule Check (DRC)

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Lab Activity:

- Placing components and routing for the schematic designed earlier
- Performing DRC and correcting errors

Module IV: PCB Output Files

- Generating Gerber files, drill files, and BOM

Lab Activity:

- Generate Gerber files and preview using Gerber viewer

Module V: Mini Project and Testing

- Design for PCB Boards

TEXT BOOKS:

1. Walter C. Bosshart "Printed Circuit Board Design and Technology" Tata McGraw Hill
2. Clyde F. Coombs "Printed Circuit Boards: Design and Technology": McGraw-Hill

REFERENCE BOOKS:

1. Peter Dalmaris "PCB Design Using KiCad 6"
2. Kraig Mitzner "Complete PCB Design Using OrCAD Capture and PCB Editor"
3. James Angus "Electronic Product Design"

IPC Standards:

1. IPC-2221: Generic Standard on Printed Board Design
2. IPC-7351: Generic Requirements for Surface Mount Design

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