MALLA REDDY ENGINEERING COLLEGE FOR WOMEN

(Autonomous Institution-UGC, Govt. of India)
Accredited by NAAC with 'A+' Grade | Programmes Accredited by NBA
NIRF Institutional Ranking 2025 – Rank Band (201-300), MHRD, GOvt. of India
Approved by AICTE, Affiliated to JNTUH, ISO 9001:2015 Certified Institution
Maisammaguda, Dhulapally, Secunderabad 500100

Department of Electronics and Communication Engineering

B.Tech Course Structure and Syllabus (R26 Regulations)

Applicable for AY 2026-27 Batch

I Year I Semester

S.No.	Code	Course Title	L	T	P	Credits
1.	2600BS01	Matrices and Calculus	3	1	0	4
2.	2600BS02	Engineering Chemistry	3	0	0	3
3.	2605ES04	C Programming and Data Structures	3	0	0	3
4.	2604PC01	Electronic Devices and Circuits	3	1	0	4
5.	2600HS01	English for Skill Enhancement	3	0	0	3
6.	2600BS61	Engineering Chemistry Laboratory	0	0	2	1
7.	2605ES64	C Programming and Data Structures Laboratory	0	0	2	1
8.	2604PC61	Electronic Devices and Circuits Laboratory	0	0	2	1
9.	2600HS61	English Language and Communication Skills Lab	0	0	2	1
		Induction Program				
		Total	**15**	**02**	**08**	**21**

I Year II Semester

S.No.	Code	Course Title	L	T	P	Credits
1.	2600BS03	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2.	2600BS04	Advanced Engineering Physics	3	0	0	3
3.	2603ES01	Computer Aided Engineering Graphics	2	0	2	3
4.	2604PC02	Network Analysis and Synthesis	3	0	0	3
5.	2602ES02	Introduction to Electrical Engineering	2	0	0	2
6.	2600BS62	Advanced Engineering Physics Lab	0	0	2	1
7.	2605ES65	Applied Python Programming Laboratory	0	1	2	2
8.	2602ES62	Electrical Engineering Laboratory	0	0	2	1
9.	2603ES61	Engineering Workshop	0	0	2	1
		Total	**13**	**2**	**10**	**20**

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II YEAR I SEMESTER

S.No.	Code	Course Title	L	T	P	Credits
1.	2604PC03	Probability Theory and Stochastic Processes	3	0	0	3
2.	2604PC04	Signals and Systems	3	1	0	4
3.	2604PC05	Electronic Circuit Analysis	3	0	0	3
4.	2604PC06	Digital Logic Design	3	0	0	3
5.	2604PC07	Control Systems Engineering	2	0	0	2
6.	2600HS04	Innovation and Entrepreneurship	2	0	0	2
7.	2604PC62	Modeling and Simulation Laboratory	0	0	2	1
8.	2604PC63	Electronic Circuit Analysis Laboratory	0	0	2	1
9.	2604PC64	Digital Logic Design Laboratory	0	0	2	1
10.	2604SD01	Verilog Programming	0	0	2	1
11.	2600ES01	Environmental Science	1	0	0	0
		Total	**17**	**1**	**08**	**21**

II YEAR II SEMESTER

S.No.	Code	Course Title	L	T	P	Credits
1.	2600BS06	Numerical Methods and Complex Variables	3	0	0	3
2.	2604PC08	Electromagnetic Fields and Transmission Lines	3	0	0	3
3.	2604PC09	Analog and Digital Communications	3	0	0	3
4.	2604PC10	RISC and Microcontroller Architectures	3	0	0	3
5.	2604PC11	Linear and Digital IC Applications	3	0	0	3
6.	2600BS64	Computational Mathematics Laboratory using Python	0	0	2	1
7.	2604PC65	Analog and Digital Communications Laboratory	0	0	2	1
8.	2604PC66	RISC and Microcontroller Interfacing Laboratory	0	0	2	1
9.	2604PC67	Linear and Digital IC Applications Laboratory	0	0	2	1
10.	2604SD02	Linux and Shell Scripting	0	0	2	1
11	2600IP03	Innovative Product Development	0	0	2	0
		Total	**15**	**0**	**10**	**20**

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III YEAR I SEMESTER

S.No.	Code	Course Title	L	T	P	Credits
1.	2604PC12	Digital Signal Processing	3	1	0	4
2.	2604PC13	IoT Architectures and Protocols	3	0	0	3
3.	2604PC14	CMOS VLSI Design	3	0	0	3
4.		Professional Elective-I	3	0	0	3
5.		Open Elective-I	2	0	0	2
6.	2604PC68	IoT Architectures and Protocols Laboratory	0	0	2	1
7.	2604PC69	CMOS VLSI Design Laboratory	0	0	2	1
8.	2604PC70	Digital Signal Processing Laboratory	0	0	2	1
9.	2604PR01	Field-based Research Project	0	0	4	2
10.	2604SD03	FPGA based System Design	0	0	2	1
11.	2600MC01	Indian Knowledge System	1	0	0	0
		Total	**15**	**1**	**12**	**21**

III YEAR II SEMESTER

S.No.	Code	Course Title	L	T	P	Credits
1.	2604PC15	Antenna and Wave Propagation	3	1	0	4
2.	2604PC16	Wireless Communications	3	0	0	3
3.	2600HS03	Business Economics and Financial Analysis	3	0	0	3
4.		Professional Elective-II	3	0	0	3
5.		Open Elective – II	2	0	0	2
6.	2604PC71	Advanced Communications Laboratory	0	0	2	1
7.	2604PC72	Wireless Communications Laboratory	0	0	2	1
8.	2604PC73	System Verilog and UVM Laboratory	0	0	2	1
9.	2600HS63	English with Employability Skills Lab	0	0	2	1
10.	2604SD04	Embedded Hardware and Firmware Development using STM32	0	0	2	1
11.	2600MC02	Gender Sensitization */ Human Values and Professional Ethics*	1	0	0	0
		Total	**15**	**1**	**10**	**20**

***Note: For the courses Gender Sensitization and Human Values and Professional Ethics**-one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week

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IV YEAR I SEMESTER

S.No.	Code	Course Title	L	T	P	Credits
1.	2604PC17	Microwave and Optical Communications	3	0	0	3
2.	2604PC18	Embedded System Design	3	0	0	3
3.	2600HS02	Fundamentals of Management for Engineers	3	0	0	3
4.		Professional Elective-III	3	0	0	3
5.		Professional Elective – IV	3	0	0	3
6.		Open Elective – III	2	0	0	2
7.	2604PC74	Microwave and Optical Communications Laboratory	0	0	2	1
8.	2604PC75	Embedded System Design Lab	0	0	2	1
9.	2604PR02	Industry Oriented Mini Project/ Internship	0	0	4	2
		Total	**17**	**0**	**08**	**21**

IV YEAR II SEMESTER

S.No.	Code	Course Title	L	T	P	Credits
1.		Professional Elective – V	3	0	0	3
2.		Professional Elective – VI	3	0	0	3
3.	2604PR03	Project Work	0	0	24	12
4.	2600IP02	Innovation Startup	0	0	4	2
		Total	**06**	**0**	**28**	**20**

Professional Elective – I

2604PE01	Computer Organization and Operating Systems
2604PE02	Electronic Measurements and Instrumentation
2604PE03	CMOS Fabrication Technology
2604PE04	Information Theory Coding

Professional Elective - II

2604PE05	Computer Networks & Protocols
2604PE06	Artificial Neural Networks
2604PE07	Digital Signal Processors and Architectures
2604PE08	Biomedical Signal Processing

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Professional Elective-III

2604PE09	Network Security and Cryptography
2604PE10	AI for Communication
2604PE11	High Speed Electronics
2604PE12	Broadband Access Technologies

Professional Elective-IV

2604PE13	ML for Intelligent Systems
2604PE14	Digital Image Processing
2604PE15	Automotive Electronics
2604PE16	Wireless Sensor Networks

Professional Elective-V

2604PE17	Radar Systems
2604PE18	5G Communications
2604PE19	Large Language Model
2604PE20	RF Circuit Design

Professional Elective-VI

2604PE21	Satellite Communications
2604PE22	Adhoc Wireless Networks
2604PE23	Quantum Technologies
2604PE24	Nano Electronics

OPEN ELECTIVES

Open Elective-I:

2604OE01	C++ for Electronic Design Automation
2604OE02	Digital Electronics
2604OE03	Introduction to Signals and Systems

Open Elective – II

2604OE04	Principles of Communications
2604OE05	Artificial Intelligence
2604OE06	Fundamentals of Digital Signal Processing

Open Elective – III

2604OE07	5G Technology
2604OE08	Hardware for IoT Applications
2604OE09	Introduction to Digital Image Processing

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ELECTRONIC DEVICES AND CIRCUITS

B.Tech. I Year I Semester

L	T	P	C
3	1	0	4

Course Objectives:

1. To introduce the basic semiconductor devices such as diodes, transistors, their characteristics and applications.
2. To analyze simple diode circuits and transistor amplifiers.
3. To acquire the knowledge of special purpose electronic devices and their application.

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

1. Describe the working of diode, BJT and FET, their biasing methods, and deduce the expressions for device parameters/ current/ and current-voltage relationships.
2. Discuss and analyze the various diode circuits such as rectifiers, filters, clippers and clampers.
3. Design appropriate biasing circuits using BJT and analyze the low frequency transistor (BJT) amplifier circuits.
4. Analyze the low frequency FET amplifier circuits and understand the MOSFET operation.
5. Acquire the knowledge about the role of special purpose electronic devices and their applications.

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

UNIT - I

Diode: PN junction as a Diode, V-I characteristics, Diode resistance, Transition and Diffusion capacitance, Diode equivalent circuit, Specifications.

Diode Applications: Rectifiers - Half-wave, Full-wave (center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers.

UNIT - II

Bipolar Junction Transistor (BJT): Working principle, Current components, Common Base (CB), Common Emitter (CE), Common Collector (CC) configurations, Input and output characteristics, Transistor as an Amplifier.

BJT Biasing: Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Self bias, Bias Stability, Thermal runaway, Bias compensation using diodes.

UNIT - III

BJT Amplifiers: Transistor Hybrid parameter model, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

UNIT - IV

Field Effect Transistors (FET): Junction FET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion mode, Comparison of BJT and FET, FET Small Signal Model, Analysis of CS and CD JFET Amplifiers, Introduction to FinFET and CNTFET.

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UNIT - V

Special Purpose Devices: Breakdown mechanisms in Zener Diodes, Zener diode characteristics and application, Structure, operation and characteristics of SCR and UJT, Principle of operation and characteristics of Tunnel diode, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit - Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2016.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory. Pearson, 11ed., 2015.

REFERENCES:

1. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5ed., 2008.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, 7ed., 2014.
3. G.K. Mithal, Electronic Devices and Circuits, Khanna Publishers, 23ed., 2017.
4. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2017.

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ELECTRONIC DEVICES AND CIRCUITS LABORATORY

B.Tech. I Year I Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. To study the principle of working of various semiconductor devices, their characteristics and application.
2. Analyze the diodes circuits, BJT and FET amplifiers.

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

1. Identify and discuss the specifications, and Test the various passive and active electronic components including R, L, C, diodes, BJT, FET, SCR.
2. Demonstrate the characteristics of PN junction diode, Zener diode, SCR and Clippers and Clampers.
3. Design and compare various rectifier circuits with and without filter.
4. Examine the input and output characteristics of BJT and FET in various configurations and compute the various performance parameters.
5. Design the various transistor biasing circuits and obtain the frequency response of BJT and FET amplifiers.

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

PART - A

Electronic Workshop Practice (in 3 Lab sessions)

1. Identification and Testing of RLC components, Potentiometers, Switches, Transformers, Bread board, PCB.
2. Identification and Testing of Active Devices, Diodes, BJTs, FETs, LED, SCR, UJT.
3. Study and operation of Regulated Power Supply, Function Generator, Digital Multimeter, CRO.

PART - B

List of Experiments (Minimum of Twelve experiments to be done):

1. Forward and reverse bias characteristics of PN junction diode.
2. Reverse bias characteristics of a Zener diode and its application as a voltage regulator.
3. Full-wave rectifiers (center-tap and bridge) with and without capacitor filters.
4. Types of Clippers at different reference voltages.
5. Types of Clampers at different reference voltages.
6. Input and output characteristics of BJT in common base configuration.
7. Input and output characteristics of BJT in common emitter configuration.
8. Design of Self bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.
9. Frequency response of Common Emitter Amplifier.
10. JFET Characteristics.
11. Frequency response of Common Source FET Amplifier.
12. SCR Characteristics.
13. UJT Characteristics.
14. Enhancement-mode NMOS transistor characteristics.

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Major Equipment required for Laboratories:

1. Regulated DC Power Supply, (0–30V)
2. Function Generator (0-1 MHz)
3. Digital Multimeter, Voltmeters and Ammeters
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Electronic Components and Devices
7. Trainer Kits (optional but preferred for ease)

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NETWORK ANALYSIS AND SYNTHESIS

B.Tech. I Year II Semester

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand the basic concepts on RLC circuits.
2. To know the behavior of the steady state and transient states in RLC circuits.
3. To understand the two port network parameters.
4. Learn the concepts of various filters and attenuators.
5. To synthesize various networks using R, L and C combinations

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

1. Discuss the concepts of network topology and magnetically coupled circuits.
2. Compute the transient and steady state response of RLC circuits.
3. Analyze the electrical network and two port network parameters for different applications.
4. Understand and classify various filters, attenuators and equalizers.
5. Synthesize the RL, RC & RLC networks by Foster and Cauer forms.

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

UNIT - I

Network Topology and Magnetically coupled circuits: Basic cut-set and tie-set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT - II

Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses, RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT - III

Two port network parameters: Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, π, L Sections, Characteristic impedance, image transfer constants.

UNIT - IV

Filters: Classification of Filters, Filter Networks, Constant-K Filters - Low pass, High pass, Band pass, Band-stop filters; m-derived Filters - T and π filters - Low pass, high pass.
Attenuators: Types - T-Type Attenuator, π -Type Attenuator, Lattice Attenuator, Bridged T attenuator, Ladder-Type Attenuator; Equalizers.

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UNIT - V

Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non-ladder networks, Poles, Zeros analysis of network functions, Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and cauer methods.

TEXT BOOKS:

1. William H. Hayt and Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, Tata Mc Graw Hill Education, 8ed., 2012.
2. John D. Ryder, Networks, Lines and Fields, 2ed., PHI, 1999.
3. S.P. Ghosh and A.K. Chakraborty, Network Analysis and Synthesis, McGraw Hill Education, 2014.

REFERENCES:

1. Van Valkenburg, Network Analysis, 3ed., Pearson, 2016.
2. A. Sudhakar and Shyammohan S. Palli, Circuits and Networks: Analysis and Synthesis, McGraw Hill Education, 5ed.
3. Ravish R. Singh, Network Analysis and Synthesis, McGraw Hill Education, 2013.
4. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum's Outlines Series, McGraw Hill Education, 4e., 2003.

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PROBABILITY THEORY AND STOCHASTIC PROCESSES

B.Tech. II Year I Semester

L	T	P	C
3	0	0	3

Pre-requisite: Mathematics

Course Objectives:

1. This course gives basic understanding of random variables and operations that can be performed on them.
2. To know the spectral and temporal characteristics of Random Process.
3. To learn the basic concepts of Information theory, noise sources and its representation for understanding its characteristics.

Course Outcomes: Upon completing the Course, the students will be able to

1. Describe probability theory basics, random variable basics and apply the knowledge of mathematics to solve problems on Bayes Theorem.
2. Explain distribution and density functions of various single random variable, and apply the knowledge of mathematics to solve problems on mean, variance etc.
3. Discuss multiple random variables and analyze the properties and operations on multiple random variables.
4. Determine the temporal and spectral characteristics of Random Signals.
5. Apply the knowledge of random process for understanding the noise characteristics.

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

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, Generation of a Random Variable of a given PDF/CDF.

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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, 4ed.
2. Murray R Spiegel, John Schiller, R. Alu Srinivasan, Probability and Statistics – Schaum's Outlines, 3ed., McGraw Hill Education.

REFERENCES:

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, 4ed.
3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly, Probability Theory and Stochastic Processes for Engineers - Pearson, 1ed., 2011.
4. Taub and Schilling, Principles of Communication systems, TMH, 2008.
5. Y. Mallikarjuna Reddy, Probability Theory and Stochastic Processes, 4ed. Edition, University Press.

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SIGNALS AND SYSTEMS

B.Tech. II Year I Semester

L	T	P	C
3	1	0	4

Pre-Requisites: 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:

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

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

1. Understand the Characteristics of various signals, systems and their time and frequency domain analysis using transform techniques.
2. Identify the conditions for transmission of signals through systems and conditions for physical realization of systems.
3. Understand the significance of sampling theorem for baseband and band pass signals.
4. Understand the concept of correlation and PSD functions and their applications.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-

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

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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.

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 relation, Parseval's Theorem for energy / power signals, Detection of Periodic Signals in the presence of Noise by Correlation.

UNIT - V

Sampling theorem: Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing.

Z–Transforms: Concept of Z- Transform of a Discrete Sequence, Comparison of Laplace, Fourier and Z Transforms, Region of Convergence of Z-Transform, Properties of ROC for various classes of signals, Inverse Z-transform, Properties of Z-transform, Application of Z-Transform to solve difference equation.

TEXT BOOKS:

1. B.P. Lathi, Signals, Systems & Communications, BS Publications, 2008.
2. Alan V. Oppenheim, Alan. S. Willsky, S. Hamid Nawab, Signals and Systems, Pearson, 2ed., 2015.

REFERENCES:

1. Simon Haykin, Barry Van Veen, Signals and Systems, Wiley, 2ed.
2. A. Rama Krishna Rao, Signals and Systems, TMH, 2008.
3. Michel J. Roberts, Govind Sharma, Fundamentals of Signals and Systems, McGraw Hill, 2ed.
4. Signals, Systems and Transforms, Charles. L. Philips, John M. Parr and Eve A. Riskin, 4ed., 2008, Pearson Education.
5. A. Anand Kumar, Signals and Systems, PHI, 3ed., 2013.

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ELECTRONIC CIRCUIT ANALYSIS LABORATORY

B.Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. To provide hands-on experience in designing, building, and analyzing analog electronic circuits.
2. To practically implementation amplifiers, oscillators, power amplifiers, multivibrators, and waveform generators using discrete components and simulation tools.

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

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

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

List of Experiments:

PART-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.

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PART-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 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 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 tune
8. d 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 (±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)
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.)

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DIGITAL LOGIC DESIGN

B.Tech. II Year I Semester

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand common forms of number representation in logic circuits.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the Realization of Logic Gates using diodes and transistors.

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

1. Apply Boolean algebra and minimization techniques to simplify Boolean functions.
2. Design combinational circuits using logic gates.
3. Analyze latches and flip-flops to design sequential logic circuits.
4. Construct synchronous sequential circuits combining flip-flops and logic gates.
5. Utilize programmable logic devices in digital system design.

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

UNIT - I

Number Systems: Number-Base conversion, Binary Arithmetic, Complements of Numbers, Arithmetic operations with Signed numbers, Digital Codes, Error Detection and Correction codes : Parity check and Hamming code.

Boolean algebra and Logic Gates: Basic theorems and properties, Simplification using Boolean Algebra, Canonical and Standard form, Digital Logic Gates Overview.

UNIT - II

Simplification of Boolean Functions: Karnaugh Maps – 2, 3, and 4 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, NAND and NOR implementation, Don't care conditions.

Combinational Logic Design: Design procedure, Binary Adder and Subtractor, Decimal Adder, Code conversion, Magnitude comparator, Decoders and Encoders, Multiplexers and Demultiplexers, Boolean Function Implementation. Dataflow, Structural and Behavioural modelling of Combinational logic circuits using Verilog HDL.

UNIT - III

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Dataflow modelling of Sequential logic circuits using Verilog HDL.

UNIT - IV

Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters. Structural modelling of Sequential logic circuits using Verilog HDL.

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UNIT - V

Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits - Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo - N Counters. Behavioural modelling of Sequential logic circuits using Verilog HDL.

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

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design. With an Introduction to Verilog HDL, Pearson Education, 6ed., 2018.
2. Samir Palnitkar, Verilog HDL, A Guide to Digital Design and Synthesis, Pearson Education, 2ed. 2008.

REFERENCE BOOKS:

1. Zvi Kohavi & Niraj K. Jha, Switching and Finite Automata Theory, Cambridge, 3ed, 2010.
2. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4ed., 2009.
3. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11ed., 2015.
4. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengage Learning, 6ed.

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CONTROL SYSTEMS ENGINEERING

B.Tech. II Year I Semester

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

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

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

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.

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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.

REFERENCES:

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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MODELLING & SIMULATION LAB

B.Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. Understand and analyze various signals and systems concepts, including their generation, transforms, and system response using programming and simulation tools.
2. Apply probability and stochastic process concepts to generate and analyze random signals, noise, and their statistical properties.
3. Design and simulate basic control system models, such as DC motors and PID controllers, and analyze their dynamic behaviour.

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

1. Use a simulation tool for generating, analyzing and performing various operations on signals / sequences both in time and frequency domain.
2. 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.
3. Use a simulation tool for generating different Random Signals; analyze their characteristics by finding different higher order moments and noise removal applications.
4. To use simulink for Control System applications

Note:

- All the experiments are to be simulated using MATLAB or equivalent software
- Minimum of 14 experiments are to be completed / simulated.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	3	3	2	-	-	3	1	-
CO2	3	2	3	3	3	2	-	-	3	1	-
CO3	3	2	3	3	3	2	-	-	3	1	-
CO4	3	2	3	3	3	2	-	-	3	1	-

List of Experiments:

Part -A: Signals and Systems (Minimum 9 Experiments)

1. Write the code / script for generating various signals, viz. Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using waveform synthesis.
2. Write the code / script for performing different operations on signals/ sequences, viz. Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.
3. Write the code / script for finding the even and odd parts of signal / sequence and real and imaginary parts of signal.
4. Write the code / script for verifying whether a given continuous / discrete system is Linear, Time Invariant, Stable and Physically Realizable and also find response of LTI system using convolution for signals / sequences.
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

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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 where ever 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 wherever required. Also plot pole-zero diagram in S-plane.
8. Write the code/ script for finding and plotting the magnitude and phase plots 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.
11. 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.

Part- B: Probability Theory and Stochastic Processes (Minimum 3 Experiments)

12. Write the code / script for generating various random variables with different CDFs/ PDFs.
13. Write the code / script for generating Gaussian noise and for finding its mean, skewness, kurtosis, PDF and PSD.
14. Write the code / script for finding Auto Correlation and Cross Correlation of signals / sequences.
15. Write the code / script for removal of noise from the signal using Correlation.
16. Write the code / script for extraction of periodic signal masked by noise using Auto Correlation.

Part- C: Control Systems (Minimum 2 Experiments)

17. Build and Simulate a DC Motor using Simulink.
18. Implementation of a PID Controller from equations using Simulink.
19. Time response analysis of second order systems or stability analysis using root locus.
20. Controllability and observability of Linear systems.

Note: For the experiments with code/scripts written in MATLAB or equivalent (1-8, 12-16), 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

   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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ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

II Year B.Tech. II Sem

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 physics and 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: Upon completing the Course, the students will be able to:

1. Acquire knowledge of Basic Laws, concepts and solve problems related to Electrostatic Fields and Magnetostatics Fields.
2. Differentiate the static and time-varying EM fields and apply Maxwell's Equations at different Boundaries.
3. Classify conductors and dielectric materials and analyze the Wave Propagations in those mediums.
4. Solve transmission line problems numerically and using Smith charts.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	1	-	-	-	1	-
CO2	3	3	2	1	-	1	-	-	-	1	-
CO3	3	3	2	1	-	1	-	-	-	1	-
CO4	3	3	2	1	-	1	-	-	-	1	-

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 in differential and integral forms, 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, Electric Boundary Conditions.

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, Faraday's Law, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations for Magnetostatic fields in differential and integral forms, Magnetic Boundary Conditions.

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UNIT - III

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 - IV

Transmission Lines: Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Condition for Distortion less transmission lines, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Smith Chart- Configuration and Applications, Single Stub Matching.

UNIT - V

Waveguides: Rectangular Waveguides - Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode.

TEXT BOOKS:

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

REFERENCES:

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

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DIGITAL LOGIC DESIGN LABORATORY

B.Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. Learn various techniques for logic minimization.
2. To acquire knowledge of combinational and sequential circuits.
3. Learn the language fundamentals of Verilog HDL and able to simulate and synthesize digital circuits.

Course Outcomes: After completing the course, students will be able to:

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

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

PART-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 7-segment decoder logic.

PART-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 Equivalent.**

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 behavioural modeling.

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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.

Realize one of the designs simulated in Part-B using discrete components / ICs.

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

Required Software Tools (for Verilog HDL Experiments) (Any one of the tool 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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ELECTRONIC CIRCUIT ANALYSIS

II B.Tech. I Semester

L	T	P	C
3	0	0	3

Course Objectives:

1. To familiarize the students with design and analysis of various amplifiers.
2. To understand the concepts of positive and negative feedback in amplifiers.
3. To familiarize the students with the working various feedback amplifiers, oscillators, power amplifiers.
4. To understand the working of multivibrator circuits and time base generators.

Course Outcomes (COs):

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

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

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

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-π model, Hybrid-π parameters: Conductances 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

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.

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UNIT - IV

Power Amplifiers and Tuned 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, Concept of Tuned Amplifiers: Single Tuned and Double Tuned Amplifiers.

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. Jacob Millman, Christos C. Halkias, Satyabrata Jit - Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2016.
2. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5ed., 2008.

REFERENCES:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11ed., 2015.
2. Jacob Millman and Arvin Grabel, Microelectronics, 2ed., McGraw Hill.
3. Jacob Millman and Herbert Taub, Pulse, Digital, and Switching Waveforms, McGraw Hill Education, 1991.
4. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 7ed., Oxford University Press, 2015.

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ANALOG AND DIGITAL COMMUNICATIONS

B.Tech. II Year II Semester

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

1. Design and analyze various analog and digital modulation and demodulation techniques.
2. Understand the effect of noise present in continuous wave modulation techniques.
3. Understand the concept of Super heterodyne receiver and Pulse modulation techniques.
4. Analyze and design the various coding techniques and Base band transmission.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	1	-	3	2	-	-	-	-
CO2	3	3	3	1	-	2	2	-	-	-	-
CO3	3	3	3	1	-	2	2	-	-	-	-
CO4	3	3	3	1	-	3	2	-	-	-	-

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

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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's 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.

TEXTBOOKS:

1. Wayne Tomasi, Electronics Communication Systems - Fundamentals through Advanced, 5ed., PHI, 2009.
2. K. Sam Shanmugam, Digital and Analog Communication System, Wiley, 2019.
3. Herbert Taub, Donald L. Schiling, Goutam Saha, Principles of Communication Systems, 3ed., McGraw Hill, 2008.

REFERENCES:

1. Dennis Roddy and John Coolen, Electronic Communications, 4ed., Pearson, 2008.
2. George Kennedy and Bernard Davis, Electronic Communication Systems, 4ed.,TMH, 2009.
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5ed., 2022.

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RISC AND MICROCONTROLLER ARCHITECTURES

B.Tech. II Year II Semester

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To familiarize with the architecture of microprocessor and microcontrollers.
2. To provide the knowledge about interfacing techniques of bus and memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors.

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

1. Discuss and compare the internal architecture and organization of 8086 microprocessor and 8051 microcontrollers.
2. Demonstrate programming proficiency using various addressing modes and instructions set of 8051 microcontroller.
3. Illustrate the use of interrupts, serial communication, timers for real time control in 8051 with programming.
4. Illustrate the interfacing of I/O and memory devices with 8051 and understand the various serial communication and bus interface units.
5. Discuss the internal architecture of ARM processors and understand the addressing modes and instruction set of ARM.
6. Outline the architecture of ARM Cortex-M processors.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	-	2
CO2	3	2	2	2	3	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	2
CO4	3	3	3	2	3	-	-	-	-	-	2
CO5	2	1	-	1	2	-	-	-	-	-	2
CO6	2	1	-	1	1	-	-	-	-	-	2

UNIT - I

8086 Microprocessor: 8086 Architecture - Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, interrupts of 8086.

8051 Microcontroller: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Counter and Timers, Serial Data Input / Output, Interrupts, Addressing Modes and Instruction set of 8051.

UNIT - II

8051 Real Time Control: Programming 8051 Timers, Programming 8051 Serial port. Programming Timer interrupts, External Hardware Interrupts, Programming the Serial Communication Interrupt. Interfacing of LCD, Keyboard, ADC and DAC, External Memory. Serial Communication standards – RS 232, USB.

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UNIT - III

ARM Architecture: RISC Design Philosophy, ARM Design Philosophy, ARM Programmer's model - Registers, CPSR, Pipeline, Exceptions, Interrupts and Vector Table, Architecture Revisions, ARM Processor families.

ARM Instruction Set: Data types, Memory organization, Data processing instructions, branch instructions, load-store instructions, software interrupt instructions, program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT - IV

ARM Cortex-M Architecture: Introduction to Cortex-M Microcontroller, ARM Instruction Set Architecture (ISA), Register Set, Processor Operating modes.

UNIT - V

ARM Cortex-M Features: Interrupts and Processor Reset Sequence, Pipelined Architecture and Data Path, Memory Address Map, Nested Interrupt Vector Controller (NVIC), Bus System, Memory and Peripherals, Debug System.

TEXT BOOKS:

1. M.A. Mazidi, J.G. Mazidi and Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems using Assembly and C, 2ed., Pearson Education, 2007.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide Designing and Optimizing System software, Elsevier, 2004.
3. Muhammad Tahir and Kashif Javed, ARM Microprocessor System, CRC Press, 2017.

REFERENCES:

1. Kenneth. J. Ayala, The 8051 Microcontroller, Cengage Learning, 3ed., 2004.
2. Steve Furber, ARM System-on-Chip Architecture, 2ed., Pearson Education, 2000.
3. Lyla B. Das, "Architecture, Programming and Interfacing of Low-power Processors - ARM 7, Cortex-M", Cengage, 1ed., 2017.

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LINEAR AND DIGITAL IC APPLICATIONS

B.Tech. II Year II Semester

L	T	P	C
3	0	0	3

Pre-requisite: Switching Theory and Logic Design.

Course Objectives:

1. Impart the concepts of Op-Amp, 555 Timers, IC regulator, data converter and its characteristics.
2. Illustrate the linear and nonlinear applications of operational amplifier.
3. Design combinational and sequential circuits with IC, memories and PLD.

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

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Explain the concepts of IC555 timer, IC723 regulator, memories and PLD.
4. Design logic functions of Combinational and Sequential circuits with ICs.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	-	-	-	-	-	-
CO2	3	3	3	1	-	-	-	-	-	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-

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 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

Logic Families: Digital IC characteristics, TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs, Comparison of TTL and CMOS logic families.

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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. Ramakant A. Gayakwad, Op-Amps & Linear Integrated Circuits, PHI, 4ed., 2012.
2. Thomas L. Floyd, Digital Fundamentals, Pearson, 11ed., 2015.

REFERENCES:

1. D. Roy Choudhury and Shail B. Jain, Linear Integrated Circuits, New Age International Publishers, 2ed, 2003.
2. John. F. Wakerly, Digital Design Principles and Practices, Pearson, 3ed., 2009.
3. S. Salivahanan and V.S. Kanchana Bhaaskaran, Linear Integrated Circuits, 3ed., McGraw Hil Education, 2018.
4. William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, 4ed., Pearson Education, 2009.

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ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

B.Tech. II Year II Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. Implement analog modulation techniques such as AM and FM using hardware and simulation tools.
2. Analyze pulse modulation techniques and verify the sampling theorem through practical observations.
3. Implement and evaluate digital modulation techniques and system performance using constellation diagrams, eye diagrams, matched filters, and source coding.

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

1. Design and implement various Analog modulation and demodulation techniques and observe the time and frequency domain characteristics of these modulated signals.
2. Design and implement various Pulse modulation and demodulation techniques and observe the time and frequency domain characteristics of these modulated signals.
3. Understand the concept of aliasing and different types of sampling with various sampling rates and duty cycles by implementing practically.
4. Design and implement various Digital modulation and demodulation techniques and observe the waveforms of these modulated signals practically.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	3	1	2	2	-	2	3	2	-
CO2	1	-	3	1	2	2	-	2	3	2	-
CO3	1	-	3	1	2	2	-	2	3	2	-
CO4	1	-	3	1	2	2	-	2	3	2	-

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.

Cycle 1:

Amplitude modulation, Pulse modulation, Sampling and Multiplexing (Minimum 6 experiments need to be carried out)

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 demodulated DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically.
4. Generate modulated and demodulated SSB-SC Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate

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theoretically and practically the modulation index in each case.

5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting atleast 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.

Cycle 2:

Digital Modulation, Signal Analysis & Source Coding (Minimum 6 experiments need to be carried out)

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 Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot and Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram.
17. Demonstrate ISI through eye diagram.
18. Simulate raised cosine signal and duo binary signals.
19. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
20. Analyze the performance of a Matched filter

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LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

B.Tech. II Year II Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. Know and verify the concepts of 741 Op-Amp, IC555 timer, IC723 and data converters.
2. Know the various characteristics of TTL and CMOS gates and implement the circuits with Digital ICs.
3. Contrast the differences between linear and digital ICs.

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

1. Design and implementation of various analog circuits using 741 ICs.
2. Design and implementation of various Multivibrators using 555 timer.
3. Design and implement ADC, DAC and voltage regulators.
4. Design various combinational circuits and sequential circuits using digital ICs.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	0	3	3	3	-	-	-	3	3	-
CO2	1	0	3	3	3	-	-	-	3	3	-
CO3	1	0	3	3	3	-	-	-	3	3	-
CO4	1	0	3	3	3	-	-	-	3	3	-

List of Experiments

PART-A

Linear IC Applications (Minimum of Eight experiments to be performed)

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 an Integrator and a Differentiator Circuit 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 a period of 1 KHz and draw the output waveform.
7. Construct Monostable Multivibrator using IC555 and draw its output waveform.
8. Construct Astable 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.

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PART-B

Digital IC Applications (Minimum of Six experiments to be performed)

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 8x1multiplexer using digital ICs.
17. Design a 4-bit Adder / Subtractor using digital ICs and Add / Subtract 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/down counter 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.

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RISC AND MICROCONTROLLER INTERFACING LABORATORY

B.Tech. II Year II Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. Develop the programming knowledge of 8051 and ARM Cortex M3 Microcontrollers.
2. Understand the usage of Integrated Development Environment (Keil and Flash Magic).
3. Control the operation of various peripherals using 8051 and ARM Cortex M3 microcontroller.

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

1. Develop the programs of 8051 and ARM Cortex-M3 microcontrollers using their respective instruction set.
2. Understand the usage of various debugging tools available to program different microcontrollers.
3. Build code for 8051 and ARM Cortex microcontrollers to interface various input/output modules.
4. Analyze the hardware and software interaction and integration.
5. Design and develop the 8051 and ARM Cortex based embedded systems for various applications.

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

Cycle 1:

Using 8051 Microcontroller Kit

- Introduction to IDE

1. Assembly Language Programs to Perform: Arithmetic (Both Signed and Unsigned), 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions.
2. Time delay Generation using Timers of 8051.
3. Serial Communication from / to 8051 to / from I/O devices.
4. Program using Interrupts to Generate Square Wave 10 KHz Frequency on P2.1 using Timer 0 8051 in 8-bit Auto reload mode and Connect a 1 Hz Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHz.

Cycle 2:

Interfacing I/O Devices to 8051

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8-bit ADC Interface to 8051.

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5. Triangular Wave Generator through DAC interfaces to 8051.

Cycle 3

Experiments to be carried out on Cortex-M3 development board and using GNU toolchain

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

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