Department of Electronics and Communication Engineering

CIRCULAR

It is to inform that the second BOS meeting will be held on 18-08-2025 at 2 PM online in Google Meet to discuss the following agenda points.

Item-1: Introduction of Board of Studies New Members

Item-2: B.Tech ECE I & II Year Course Structure and Detailed Syllabus

Item-3: B.Tech CSE & CSE – AIML I & II Year Service Courses Detailed Syllabus

Item-4: Any other points with the permission of the chair

Chinnam S V Maruthi Rao

HoD & BOS Chair

Department of Electronics and Communication Engineering

Board of Studies (BOS) Members

S.No	Name	Designation	Position	Signature
1	Mr. Ch. S. V. Maruthi Rao	Assoc. Professor & Head of the Department	Chairperson	
2	Dr. Kancharla Anitha Sheela	Professor, Department of ECE, JNTUH	Member- JNTUH Nominee	
3	Dr. L. Nirmala Devi	Professor, Department of ECE, University College of Engineering, Osmania University, Hyderabad	Member From Osmania University Subject Expert-1	
4	Dr. P. Lavanya	Associate Professor, Department of ECE, Sreenidhi Institute of Science and Technology, Hyderabad	Member from Affiliated Autonomous Colleges Subject Expert-2	
5	Mr. B. Bhaskar Rao	Head – R&D, ISQUARE Systems	Member From Industry /R&D Expert	
6	Mrs. R. Mrudula	Associate Blockchain Developer, National Payments Corporation of India	Member Alumni	
7	Dr. J. Pandu	Professor	Member Internal Faculty	
8	Dr. N. Murali Krishna	Professor	Member Internal Faculty	
9	Mr. B. Sreenivasu	Assoc. Prof	Member Internal Faculty	
10	Dr. B. Ashok	Asst. Professor	Member Internal Faculty	
11	Dr. B. Spandana	Asst. Professor	Member Internal Faculty	
12	Mr. G. Vijay Goud	Assoc. Professor	Member Internal Faculty	
13	Mrs. M. Pavani	Asst. Professor	Member Internal Faculty	
14	Mrs. A. Sowjanya	Asst. Professor	Member Internal Faculty	
15	Mrs. L. Divya Reddy	Asst. Professor	Member Internal Faculty	

Department of Electronics and Communication Engineering

Minutes of Meeting

Minutes of meeting of Board of Studies (BOS), ECE Department conducted on 18-08-2025 at 2:00 pm online in Google Meet.

AGENDA:

Item-1: Introduction of Board of Studies New Members

Item-2: B.Tech ECE I & II Year Course Structure and Detailed Syllabus

Item-3: B.Tech CSE & CSE – AIML I & II Year Service Courses Detailed Syllabus

Item-4: Any other points with the permission of the chair

Points Discussed:

Item-1: The BoS chairman Mr. Chinnam S V Maruthi Rao welcomed all members and JNTUH nominee Dr. K. Anitha Sheela in the meeting

Item – 2: B.Tech I & II Year Course Structure is presented. Dr. K. Anitha Sheela has suggested keeping the name of Basic Electrical Engineering as is prescribed by JNTUH as "Introduction to Electrical Engineering" as the number of credits are only 2 compared to Basic Electrical Engineering of CSE & CSE – AIML which has 3 credits. The Content of "Introduction to Electrical Engineering" is slightly different from that of "Basic Electrical Engineering".

It is proposed to remove "Linux and Shell Scripting" and "Web and Mobile Applications" subjects from the curriculum and the subsequent credits to be adjusted in Control Systems and Numerical Methods and Complex variables. But, As per the suggestions of Dr. Anitha Sheela these courses come under Skill Development and it is mandatory to have those courses with 1 credit each. So these Courses are unchanged.

In II Year II Semester –Electromagnetic Fields and Transmission Lines, the concept of Wave Guides is not available. In view of the lengthy syllabus of Electromagnetic Fields

and Transmission Lines, Dr. K. Anitha Sheela has suggested to include this concept in Microwave and Optical Communications of IV Year I Semester.

All the subjects as given by JNTUH are followed including the syllabus and credits with an exception of Ordinary Differential Equations and Vector Calculus in I Year II Semester. One Tutorial is added for this subject making the total number of credits as 4. This credit is compensated from Linear and Digital IC Applications subject of II Year II Semester. The number of credits for this subject is changed from 3 to 2. To compensate for the total number of credits for Minimum of 20, Environmental science with 1 credit is changed from II Year I Semester to II Year II Semester.

No Changes are made in the Lab Syllabus and Theory Syllabus.

Item – 3: No Changes are made in the Lab Syllabus and Theory Syllabus of the following subjects of Computer Science and Engineering and Computer Science and Engineering – AI&ML for I Year I & II Semesters and II Year I & II Semesters.

1. Basic Electrical Engineering
2. Electronic Devices and Circuits
3. Computer Organization and Architecture
4. Basic Electrical Engineering Lab

Item – 4: The meeting concluded with mention of Thanks to all the BOS Members for their suggestions.

Sreyas Institute of Engineering and Technology

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COMPUTER SCIENCE AND ENGINEERING

R25 B.Tech CSE Syllabus								
	BASIC ELECTRICAL ENGINEERING							
I B.Tech – II Sem					**L**	**T**	**P**	**C**
					3	**0**	**0**	**3**
Pre-requisite: Mathematics								

Course Objectives:

1. Introduce the fundamental concepts of electrical circuit elements, DC circuit laws, and basic theorems for circuit analysis.
2. Develop an understanding of AC circuit analysis using phasor representation, power calculations, and three-phase systems.
3. Explain the principles, construction, and performance evaluation of transformers.
4. Familiarize students with the construction, operation, and characteristics of DC machines, induction motors, and synchronous generators.
5. Provide knowledge of essential electrical installation components such as LT switchgear, cables, earthing, and batteries.
6. Enable students to perform practical calculations for energy consumption, power factor correction, and battery backup for real-world applications.

Course Outcomes:

1. Apply KVL, KCL, and network theorems (Superposition, Thevenin, Norton) to analyze DC circuits and transient behavior of RL/RC circuits.
2. Analyze single-phase and three-phase AC circuits using phasor representation and determine active, reactive, and apparent power along with resonance conditions.
3. Explain the construction, equivalent circuit, losses, and performance characteristics of single-phase and three-phase transformers.
4. Evaluate the operating principles and performance of DC machines, induction motors, and synchronous generators.
5. Demonstrate the applications of LT switchgear, cables, earthing systems, and batteries in electrical installations.
6. Calculate practical electrical parameters such as energy consumption, power factor improvement, and battery backup for given systems.

UNIT – I: D.C. Circuits

Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT – II: A.C. Circuits

Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections

UNIT – III: Transformers

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto transformer and three-phase transformer connections.

UNIT – IV: Electrical Machines

Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single-phase induction motor, Construction and working. Construction and working of synchronous generator

UNIT – V: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

R25 B.Tech CSE Syllabus								
	ELECTRONIC DEVICES AND CIRCUITS							
I B.Tech – I Sem					L	T	P	C
					3	0	0	3
Pre-requisite: 10+2 Physics								

Course Objectives:

1. Introduce the fundamental characteristics and applications of semiconductor diodes and their circuit implementations.
2. Explain the working principles, configurations, and characteristics of Bipolar Junction Transistors (BJTs).
3. Develop an understanding of BJT biasing techniques, operating point stability, and thermal considerations.
4. Analyze transistor amplifiers using small-signal models and h-parameter equivalent circuits.
5. Familiarize students with special-purpose diodes and their applications in electronic circuits.
6. Explore the structure, operation, and characteristics of Field Effect Transistors (FETs), MOSFETs, and advanced nanoscale devices like FinFETs and CNTFETs.

Course Outcomes:

1. Explain the I–V characteristics of semiconductor diodes and their use in rectifiers, clippers, clampers, and voltage regulation.
2. Analyze the operation and characteristics of BJTs in different configurations and extract h-parameters.
3. Apply various BJT biasing techniques to establish a stable operating point and mitigate thermal runaway
4. Evaluate the performance of transistor amplifiers (CE, CB, CC) using small-signal models and h-parameters.
5. Demonstrate the principle and applications of special-purpose diodes such as SCR, tunnel diode, varactor, photodiode, LED, and solar cell.
6. Compare and Contrast FET, MOSFET, FinFET, and CNTFET devices in terms of structure, characteristics, and scaling advantages for modern VLSI.

UNIT – I: Diode Characteristics and Applications

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

UNIT – II: Bipolar Junction Transistor (BJT)

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

UNIT – III: BJT Biasing

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

UNIT – IV: Transistor Amplifiers

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor.

UNIT – V: Special Devices

Special Purpose Diodes: Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar

Cell, LED and Schottky Diode
Field Effect Transistors and Advanced Devices: JFET: Structure, operation, and characteristics
MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics
Advanced Devices: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET

TEXT BOOKS:

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

REFERENCE BOOKS:

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

R25 B.Tech CSE Syllabus				
	COMPUTER ORGANIZATION AND ARCHITECTURE			
II B.Tech – I Sem	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**
Pre-requisite: Nil				

Course Objectives:

1. Introduce the fundamentals of digital logic, Boolean algebra, and data representation techniques essential for computer system design.
2. Develop the ability to design and analyze combinational and sequential logic circuits required for digital systems
3. Familiarize students with register transfer language, micro-operations, and basic computer organization concepts.
4. Explain the design principles of CPU, instruction sets, addressing modes, and arithmetic operations in computer systems.
5. Provide insights into control unit design using microprogramming and hardwired control techniques.
6. Introduce memory and I/O organization including memory hierarchy, cache, and DMA for efficient data processing.

Course Outcomes:

1. Apply Boolean algebra principles and digital logic to represent data and design basic logic circuits.
2. Analyze combinational and sequential circuits such as adders, multipliers, decoders, counters, and registers.
3. Explain register transfer language, micro-operations, and the basic instruction cycle of a digital computer.
4. Design and Evaluate control unit organization using microprogrammed and hardwired approaches.
5. Demonstrate the organization of CPU, instruction formats, addressing modes, and arithmetic algorithms for efficient computation.
6. Differentiate various memory and I/O organization techniques including cache, DMA, and interrupt handling mechanisms.

UNIT – I:

Boolean Algebra and Logic Gates: Binary codes, Binary Storage and Registers, Binary logic. Digital logic gates.
Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation
Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

UNIT – II:

Combinational Logic: Combinational Circuits, Analysis procedure Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, magnitude comparator, Decoders, Encoders, Multiplexers, HDL for combinational circuits.

Sequential Logic: Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, state Reduction and Assignment, Design Procedure. Registers, shift Registers, Ripple counters, synchronous counters, other counters.

UNIT – III:

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions,

Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.
UNIT – IV:
Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit. **Central Processing Unit:** General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control **Computer Arithmetic**: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations
UNIT – V:
Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access. **Memory Organization**: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory
TEXT BOOKS:
1. Digital Design – M. Morris Mano, Third Edition, Pearson/PHI
2. Computer System Architecture – M. Morris Mano, Third Edition, Pearson/PHI
3.
REFERENCE BOOKS:
1. Switching and Finite Automata Theory, ZVI. Kohavi, Tata Mc Graw Hill
2. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, 5th Edition, McGraw Hill.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson
5.

R25 B.Tech CSE Syllabus

BASIC ELECTRICAL ENGINEERING LAB

	L	T	P	C
I B.Tech – II Sem	3	0	0	3
Pre-requisite: Mathematics				

Course Objectives:

1. Provide hands-on experience in verifying basic electrical laws (KVL, KCL) and theorems (Thevenin, Norton, Superposition).
2. Develop practical skills to analyze DC transients and AC resonance phenomena in RLC circuits.
3. Familiarize students with the performance evaluation of single-phase transformers through voltage, current, efficiency, and regulation tests.
4. Demonstrate the characteristics of DC and AC machines, including DC shunt motors, three-phase induction motors, and alternators.
5. Train students in experimental measurement of electrical quantities such as voltage, current, active power, reactive power, and impedance.
6. Strengthen the ability to apply theoretical concepts of Basic Electrical Engineering to real-world systems through laboratory practice.

Course Outcomes:

1. Verify KVL, KCL, and network theorems (Thevenin, Norton, and Superposition) experimentally.
2. Analyze the transient response of RL/RC circuits and resonance behavior in RLC circuits.
3. Determine impedance, current, and power in AC series circuits (RL, RC, RLC) using experimental methods
4. Evaluate the voltage, current, efficiency, and regulation characteristics of single-phase and three-phase transformers.
5. Examine the performance characteristics of rotating machines such as DC shunt motors, induction motors, and alternators.
6. Measure and Interpret active and reactive power in balanced three-phase systems using practical setups.

PART - A: Compulsory

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor

PART - B: Minimum Two experiments from the given list

1. Verification of Superposition theorem
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit
5. No-Load Characteristics of a Three-phase Alternator

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ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE & SYLLABUS

(R25 Regulations - Autonomous)

Applicable from AY 2025-26 Batch

I Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1		Matrices and Calculus	3	1	0	4
2		Advanced Engineering Physics	3	0	0	3
3		Programming for Problem Solving	3	0	0	3
4		Introduction to Electrical Engineering	2	0	0	2
5		Engineering Drawing and Computer Aided Drafting	2	0	2	3
6		English for Skill Enhancement	3	0	0	3
7		Advanced Engineering Physics Lab	0	0	2	1
8		Programming for Problem Solving Lab	0	0	2	1
9		English Language and Communication Skills Lab	0	0	2	1
10		Induction Programme				
		Total Credits	**16**	**1**	**8**	**21**

I Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1		Ordinary Differential Equations and Vector Calculus	3	1	0	4
2		Engineering Chemistry	3	0	0	3
3		Python Programming	3	0	0	3
4		Data Structures	3	0	0	3
5		Network Analysis and Synthesis	3	0	0	3
6		Python Programming Lab	0	0	2	1
7		Engineering Chemistry Lab	0	0	2	1
8		Data Structures Lab	0	0	2	1
9		Electrical Engineering Lab	0	0	2	1
10		Engineering Workshop	0	0	2	1
		Total Credits	**15**	**1**	**10**	**21**

II YEAR I SEMESTER

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	2	0	0	2
6		Innovation and Entrepreneurship	2	0	0	2
7		Modeling 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
		Total Credits	**16**	**0**	**8**	**20**

II YEAR II SEMESTER

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		Linear and Digital IC Applications	2	0	0	2
5		Electronic Circuit Analysis	3	0	0	3
6		Computational Mathematics Lab	0	0	2	1
7		Analog and Digital Communications Lab	0	0	2	1
8		Linear and Digital IC Applications Lab	0	0	2	1
9		Electronic Circuit Analysis Lab	0	0	2	1
10		Web and Mobile Applications	0	0	2	1
11		Environmental Science	1	0	0	1
		Total Credits	**15**	**0**	**10**	**20**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Digital Signal Processing	3	0	0	3
2		RISC and Microcontroller Architectures	3	0	0	3
3		CMOS VLSI Design	3	0	0	3
4		Professional Elective – I	3	0	0	3
5		Open Elective - I	2	0	0	2
6		RISC and Microcontroller Interfacing Laboratory	0	0	2	1
7		CMOS VLSI Design Laboratory	0	0	2	1
8		Digital Signal Processing Laboratory	0	0	2	1
9		Field based Research Project	0	0	4	2
10		FPGA based System Design	0	0	2	1
11		Indian Knowledge System	1	0	0	1
		Total Credits	**14**	**0**	**12**	**21**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Antenna Design and Wave Propagation	3	0	0	3
2		IoT Architectures and Protocols	3	0	0	3
3		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		Advanced Communications Laboratory	0	0	2	1
7		IoT Architectures and Protocols Laboratory	0	0	2	1
8		VLSI Design Verification Laboratory	0	0	2	1
9		Advanced English Communication Skills Lab	0	0	2	1
10		45G Practical Lab / Robotic Lab / Drone lab	0	0	2	1
11		Gender Sensitization lab / Human Values and Professional Ethics	1	0	0	1
		Total Credits	**15**	**0**	**10**	**20**

Professional Elective – I

	Computer Organization & Operating Systems
	Data Communications and Computer Networks
	Electronic Measurements and Instrumentation
	Sustainability for Electronics

Professional Elective – II

	Digital Image Processing
	Low Power VLSI Design
	Wireless Communication Networks
	Biomedical Instrumentation

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Microwave and Optical Communications	3	0	0	3
2		Embedded System Design	3	0	0	3
3		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		Microwave and Optical Communications Laboratory	0	0	2	1
8		Embedded System Design Laboratory	0	0	2	1
9		Industry Oriented Mini Project / Internship	0	0	4	2
		Total Credits	**17**	**0**	**8**	**21**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective – V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Project Work	0	0	28	14
		Total Credits	**6**	**0**	**28**	**20**

Professional Elective – III

	Fundamentals of Artificial Intelligence
	Image and Video Processing
	Mobile Communications and Networks
	Design for Testability

Professional Elective – IV

	Deep Learning
	Satellite Communications
	CMOS Analog IC Design
	Real Time Operating Systems

Professional Elective – V

	DSP Processors and Architectures
	Multimedia Database Management Systems
	Cloud Computing
	5G and beyond Communication

Professional Elective – VI

	Block chain Technology
	System on Chip Architecture
	Wireless sensor Networks
	Network Security and Cryptography

R25 B.Tech ECE Syllabus

INTRODUCTION TO ELECTRICAL ENGINEERING

I B.Tech – I Sem	**L**	**T**	**P**	**C**
	2	**0**	**0**	**2**

Pre-requisite: Mathematics

Course Objectives:

1. To understand DC and Single & Three phase AC circuits
2. To study and understand the different types of DC, AC machines and Transformers
3. To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes:

1. Understand and analyze basic Electrical circuits
2. Study the working principles of Electrical Machines and Transformers
3. Introduce components of Low Voltage Electrical Installations

UNIT – I: D.C. Circuits

Introduction to R, L and C elements, Independent voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits

UNIT – II: A.C. Circuits

Introduction to sinusoidal waveforms, phasor representation, the concept of power and power factor, Analysis of 1-phase RLC series and parallel circuits, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections

UNIT – III: Transformers

Principle of operation, equivalent circuit, losses, regulation and efficiency. Introduction to Auto-transformer.

UNIT – IV: Electrical Machines

Principle of operation of DC machine, performance characteristics of dc shunt machine. Principle of operation of a 3-phase induction motor, torque-slip characteristics. Principle of operation of synchronous generator.

UNIT – V: Electrical Installations

Components of LT Switchgear: SFU, MCB, ELCB, Types of Wires and Cables, Earthing. Types of Batteries, and Characteristics. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, “Basic Electrical Engineering”, S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, “Basic Electrical and Electronics Engineering”, Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, “Basic Electrical Engineering”, 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011
6. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010
7. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989

R25 B.Tech ECE Syllabus				
	NETWORK ANALYSIS AND SYNTHESIS			
I B.Tech – II Sem	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**
Pre-requisite: Basic Electrical Engineering				

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 design concepts of various filters and attenuators

Course Outcomes:

1. Gain the knowledge on basic RLC circuits behaviour
2. Analyse the Steady state and transient analysis of RLC Circuits.
3. Characterization of two port network parameters.
4. Analyse the Design aspect of various filters and attenuators

UNIT – I: Network Topology

Basic cutset 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, Design of Attenuators, impedance matching network

UNIT – IV: Filters & Attenuators

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, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers-Types- Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

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 causer methods

TEXT BOOKS:

1. Van Valkenburg -Network Analysis, 3rd Ed., Pearson, 216

2. JD Ryder - Networks, Lines and Fields, 2nd Ed., PHI, 1999
REFERENCE BOOKS:
1. J. Edminister and M. Nahvi - Electric Circuits, Schaum's Outlines, Mc Graw Hills Education, 1999
2. A. Sudhakar and Shyammohan S Palli - Networks & Circuits, 4th Ed., Tata McGraw- Hill Publications
3. William Hayt and Jack E. Kimmerley - Engineering Circuit Analysis, 6th Ed., William Hayt and Jack E. Kimmerley, McGraw Hill Company

R25 B.Tech ECE Syllabus						
	ELECTRICAL ENGINEERING LAB					
I B.Tech – II Sem			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Pre-requisite: Introduction to Electrical Engineering						

Course Objectives:

1. To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
2. To study the transient response of various R, L and C circuits using different excitations.
3. To determine the performance of different types of DC, AC machines and Transformers.

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

1. Verify the basic Electrical circuits through different experiments.
2. Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
3. Analyze the transient responses of R, L and C circuits for different input conditions.

PART – A (compulsory)

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RLC series and Parallel AC circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART – B (Any Two)

1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. No-Load Characteristics of a Three-phase Alternator

R25 B.Tech ECE Syllabus				
PROBABILITY THEORY AND STOCHASTIC PROCESSES				
II B.Tech – I Sem	**L**	**T**	**P**	**C**
	3	0	0	3
Pre-requisite: Mathematics				

Course Objectives:

1. This 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:

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

UNIT – I: Probability and Radom Variables

Probability: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events.

Random Variables: Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

UNIT – II: Operations on single Random Variable

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Computer generation of a Random Variable of a given PDF/CDF.

UNIT – III: Multiple random variables and Operations on Multiple random variables

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution (Proof not expected).
Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT – IV: Random processes – Temporal characteristics

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

Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output

UNIT – V: Random processes – Spectral characteristics

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.
Noise sources: Resistive / Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. P Ramesh Babu - Probability Theory and Random Processes – McGraw Hill Education
2. Athanasios Papoulis and S. 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

R25 B.Tech ECE Syllabus								
		SIGNALS AND SYSTEMS						
II B.Tech – I Sem					**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 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:

1. Characterize 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 for various types of sampling and for different duty cycles
4. Understand the concept of correlation and PSD functions and their applications

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, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function

UNIT – II: Fourier Series and Transforms

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

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

UNIT – III: Signal Transmission through Linear Systems

System & Types of System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. 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 and Correlation

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

Correlation: Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Parseval's Theorem
UNIT – V: Z-Transforms & Sampling Theorem
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. **Sampling theorem:** Graphical and analytical proof of Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing
TEXT BOOKS:
1. Signals, Systems & Communications -B.P. Lathi, BS Publications
2. Signals and Systems – Allan. V. Oppenheim, Allan. S. Willsky with S. Hamid. Nawab, 2nd Ed. Pearson.
REFERENCE BOOKS:
1. Signals and Systems–Simon Haykin, Barry Van Veen, 2nd Ed., Wiley
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH
3. Fundamentals of Signals and Systems – Michel J. Roberts, Govind Sharma, 2nd Ed., MGH
4. Signals, Systems and Transforms - Charles. L. Philips, John M. Parr and Eve A. Riskin, 4th Ed., 2004, Pearson, Prentice Hall

R25 B.Tech ECE Syllabus								
	ELECTRONIC DEVICES AND CIRCUITS							
II B.Tech – I Sem					**L**	**T**	**P**	**C**
					3	**0**	**0**	**3**
Pre-requisite: 10+2 Physics								

Course Objectives:

1. To impart knowledge of semiconductor diodes, their electrical characteristics, and practical applications such as rectifiers, regulators, clippers, and clampers in electronic circuits.
2. To explain the structure, working principles, and characteristics of Bipolar Junction Transistors (BJT) in different configurations and enable students to analyze their input–output behavior using h-parameters.
3. To develop an understanding of BJT biasing techniques and the importance of stabilization, load line, and thermal considerations in ensuring reliable transistor operation.
4. To introduce the concept of transistor amplifiers and equip students with analytical skills to evaluate small-signal models and performance parameters of CE, CB, and CC amplifiers.
5. To familiarize students with special-purpose diodes, FETs, MOSFETs, and advanced nanoelectronic devices (such as FinFETs and CNTFETs), highlighting their structures, operations, and comparative advantages in modern VLSI applications.

Course Outcomes:

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) 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 h-parameter models and assess performance for various configurations
5. Analyze the structure, working, and characteristics of JFETs, MOSFETs, and advanced devices like FinFETs and CNTFETs, and compare modern device technologies
6.

UNIT – I: Diode Characteristics and Applications

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

UNIT – II: Bipolar Junction Transistor (BJT)

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

UNIT – III: BJT Biasing

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

UNIT – IV: Transistor Amplifiers

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor.

UNIT – V: Special Devices
Special Purpose Diodes: Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode **Field Effect Transistors and Advanced Devices:** JFET: Structure, operation, and characteristics **MOSFET:** Enhancement and Depletion modes – Structure, operation, and characteristics **Advanced Devices**: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET
TEXT BOOKS:
1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. Tata McGraw-Hill, 1991.
2. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. Pearson, 11th ed., 2013.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. Oxford University Press, 7th ed., 2014.
REFERENCE BOOKS:
1. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 5th ed., 2008
2. Neamen, Donald A. Electronic Circuit Analysis and Design. McGraw-Hill, 2nd ed., 2001.
3. Salivahanan, S., and N. Suresh Kumar. Electronic Devices and Circuits. McGraw-Hill Education, 4th ed., 2017.
4. Razavi, Behzad. Fundamentals of Microelectronics. Wiley, 2nd ed., 2013.
5. Taur, Yuan, and Tak H. Ning. Fundamentals of Modern VLSI Devices. Cambridge University Press, 2nd ed., 2009.

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R25 B.Tech ECE Syllabus				
	DIGITAL LOGIC DESIGN			
II B.Tech – I Sem	**L**	**T**	**P**	**C**
	3	0	0	3
Pre-requisite: Mathematics				

Course Objectives:

1. To introduce the fundamentals of number systems, binary arithmetic, and error detection/correction techniques for reliable digital system design.
2. To develop the ability to apply Boolean algebra and gate-level minimization techniques for the simplification and efficient implementation of logic functions.
3. To provide knowledge of combinational logic circuit design and analysis, including arithmetic circuits, comparators, decoders, encoders, multiplexers, and demultiplexers.
4. To impart understanding of sequential logic circuits and their design methodologies, covering latches, flip-flops, counters, and shift registers with practical applications.
5. To familiarize students with synchronous sequential logic, state machine modeling, and programmable logic devices (PLA, PAL, ROM, RAM) for the design of real-world digital systems.

Course Outcomes:

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

UNIT – I: Number Systems and Boolean Algebra

Number Systems: Binary, Octal, Decimal, Hexadecimal, Fixed-point and Floating-point Number Representations, Complements of Numbers: 1's and 2's Complement, Error Detection and Correction **Codes**: Parity Check, Hamming Code.
Boolean Algebra and Logic Gates: Axiomatic definitions, basic theorems and properties,
Boolean Functions: Canonical and standard forms, Digital Logic Gates Overview.

UNIT – II: Gate-Level Minimization Techniques

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

UNIT – III: Combinational Logic Circuits

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

UNIT – IV: Sequential Logic Circuits - I

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

UNIT – V: Sequential Logic Circuits – II

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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R25 B.Tech ECE Syllabus				
	CONTROL SYSTEMS			
II B.Tech – I Sem	**L**	**T**	**P**	**C**
	2	**0**	**0**	**2**
Pre-requisite: Mathematics; Network Analysis & Synthesis				

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:

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

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

Time response Analysis: Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability.

Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response

UNIT – III: Frequency response Analysis

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

UNIT – IV: Compensators and Controllers

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

UNIT – V: State space representation

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

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TEXT BOOKS:	
1.	I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009
2.	Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010
REFERENCE BOOKS:	
1.	K. Ogata, Modern Control Engineering, 2ed. Prentice Hall, 2010.
2.	M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997
3.	Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007
4.	A.K. Jairath, Solutions and Problems of Control Systems, CBS Publishers, 2013.
5.	A. Nagoor Kani, Control Systems, 2ed., RBA Publications, 2007

R25 B.Tech ECE Syllabus							
	MODELLING & SIMULATION LAB						
II B.Tech – I Sem				**L**	**T**	**P**	**C**
				0	**0**	**2**	**1**
Pre-requisite: Mathematics							

Course Objectives:

1. To develop practical skills in signal generation, transformation, and analysis (both continuous and discrete) using MATLAB/Simulink or equivalent tools.
2. To provide hands-on experience in system characterization and response analysis, including linearity, time invariance, stability, frequency response, Fourier/Laplace/Z-transforms, and pole-zero analysis.
3. To apply probability theory and stochastic processes in simulating and analyzing random variables, Gaussian noise, sampling theorem verification, and noise removal techniques.
4. To introduce the modeling and simulation of control systems (such as DC motors and PID controllers) and to analyze their controllability and observability using modern computational tools.

Course Outcomes: After learning the contents of this paper the student must 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 generating, analyzing and performing various operations on Signals / Sequences both in time and Frequency domain
3. Use a simulation tool for generating different Random Signals; analyze their Characteristics by finding different higher order Moments and noise removal applications
4. use a simulink for Control System applications

PART – A (Signals & Systems) – Minimum 7 Experiments

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

diagram in Z-plane
9. Design a Simulink or equivalent model for a) Solving Differential Equations b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses
10. Gibbs Phenomenon and waveform synthesis
PART – B (Probability Theory & Stochastic Processes) – Minimum 3 Experiments
11. Write the code / script for generating various Random Variables with different CDFs/ PDFs
12. Write the code / script for generating Gaussian noise and for finding its mean, Skewness, Kurtosis, PDF and PSD.
13. Write the code / script for Verifying Sampling theorem for different sampling rates, Sampling types and Duty Cycles and for plotting the sampled and reconstructed Signals
14. Write the code / script for Removal of noise from the signal using Cross correlation.
15. Write the code / script for Extraction of Periodic Signal masked by noise using Auto Correlation
PART – C (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
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

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

R25 B.Tech ECE Syllabus							
ELECTRONIC DEVICES AND CIRCUITS LAB							
II B.Tech – I Sem				**L**	**T**	**P**	**C**
				0	**0**	**2**	**1**
Pre-requisite: Physics							

Course Objectives:

1. To understand the fundamental characteristics of semiconductor devices such as diodes, BJTs, JFETs, and MOSFETs through experimental analysis in different biasing and circuit configurations.
2. To design, implement, and analyze basic electronic circuits including rectifiers, regulators, amplifiers, clippers, clampers, and digital inverters using both hardware and simulation tools.
3. To develop proficiency in the use of laboratory equipment and simulation software (e.g., CRO/DSO, function generator, LTSpice, Multisim, Proteus, PSPICE) for testing, measurement, and verification of electronic circuits.
4. To enhance problem-solving and circuit-level design skills by correlating theoretical concepts with practical implementation, thereby preparing students for advanced courses in analog and digital electronics.

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

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

PART – A (Hardware Based)

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

PART – B (Software Based)

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
3. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification
4. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital

and analog applications.
5. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and transconductance.
6. Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
7. Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

Hardware Requirements:

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

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

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

R25 B.Tech ECE Syllabus								
	DIGITAL LOGIC DESIGN LAB							
II B.Tech – I Sem					**L**	**T**	**P**	**C**
					0	**0**	**2**	**1**
Pre-requisite:								

Course Objectives:

1. To understand the fundamentals of digital logic design by realizing basic combinational and sequential circuits using standard logic ICs in the hardware laboratory.
2. To develop the ability to design and implement combinational and sequential circuits such as adders, subtractors, code converters, multiplexers, decoders, shift registers, and counters using both gates and HDL.
3. To acquire proficiency in Verilog HDL programming by applying different modeling styles (dataflow, behavioral, and structural) for the simulation and verification of digital systems.
4. To strengthen problem-solving and design skills in digital electronics by bridging theory, hardware realization, and HDL simulation, thereby preparing students for advanced courses in VLSI and digital system design.

Course Outcomes: After learning the contents of this paper the student must 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.

PART – A (Hardware Based)

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 (Software Based)

1. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7-segment decoder logic
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.
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.

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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 ISE	For Simulation and FPGA design
ModelSim	Verilog simulation and waveform analysis
Xilinx Vivado	HDL simulation and synthesis

R25 B.Tech ECE Syllabus

ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

	L	T	P	C
II B.Tech – II Sem	**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:

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. Able to classify conductors and dielectric materials and analyze the Wave Propagations in those mediums.
4. To solve transmission line problems numerically and using smith charts

UNIT – I: Electrostatics

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

UNIT – II: 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. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection

UNIT – V: Transmission Lines

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

R25 B.Tech ECE Syllabus

ANALOG AND DIGITAL COMMUNICATIONS

	L	T	P	C
II B.Tech – II Sem	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:

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

UNIT – I: Modulation Techniques – 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: Modulation Techniques – 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, Estimation and Transmission

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

Base Band Shaping for Data Transmission: Requirements of a line encoding format, various line encoding formats- Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist'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 and Source Coding
Information theory: Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR. **Source coding**: Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.
TEXT BOOKS:
1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, PHI, 2009.
2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019
3. Principles of Communication Systems - Herbert Taub, Donald L Schiling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.
REFERENCE BOOKS:
1. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5th edition, 2022

R25 B.Tech ECE Syllabus								
	ELECTRONIC CIRCUIT ANALYSIS							
II B.Tech – II Sem					**L**	**T**	**P**	**C**
					3	**0**	**0**	**3**
Pre-requisite: Electronic Devices and Circuits								

Course Objectives:

1. To provide an understanding of multistage amplifiers and high-frequency transistor models with emphasis on frequency response, bandwidth, and distortion analysis.
2. To explain the principles of feedback in amplifiers and analyze the effects of various feedback configurations on gain stability, bandwidth, noise, and distortion.
3. To impart knowledge of oscillator design and operation, including LC, RC, and crystal oscillators, based on positive feedback and Barkhausen's criterion.
4. To develop the ability to analyze and design different classes of power amplifiers with considerations of efficiency, distortion, and practical applications.
5. To familiarize students with transistor-based multivibrators and time base generators and their role in waveform generation and timing applications.

Course Outcomes:

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

UNIT – I: Multistage Amplifiers and High Frequency Transistor Model

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

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
UNIT – V: Multivibrators & Time Base Generators
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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R25 B.Tech ECE Syllabus				
	LINEAR AND DIGITAL IC APPLICATIONS			
II B.Tech – II Sem	L	T	P	C
	3	0	0	3
Pre-requisite: Digital Logic Design				

Course Objectives:

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:

1. A thorough understanding of operational amplifiers with linear integrated circuits.
2. Attain the knowledge of functional diagrams and design applications of IC555andIC565
3. Acquire the knowledge and design the Data converters
4. Understanding of the different families of digital integrated circuits and their characteristic

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-2Rladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications

UNIT – IV: Combinational Logic ICs

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

UNIT – V: Sequential Logic IC's and Memories

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

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS:

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

REFERENCE BOOKS:
1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 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.

R25 B.Tech ECE Syllabus				
ANALOG AND DIGITAL COMMUNICATIONS LAB				
II B.Tech – II Sem	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**
Pre-requisite:				

Course Objectives:

1. To understand and analyze fundamental analog and digital modulation techniques (AM, FM, PM, DSB-SC, SSB-SC, FSK, PSK, QPSK, DPSK) and their demodulation through hardware implementation and simulation.
2. To design and implement multiplexing, sampling, and pulse modulation schemes (PAM, PWM, PPM, PCM, Delta modulation) and study their practical performance through waveform, spectrum, and reconstruction analysis.
3. To gain proficiency in advanced communication system analysis tools by simulating eye diagrams, constellation diagrams, raised cosine, duobinary signals, and matched filters under noisy environments.
4. To develop problem-solving and design skills in digital communication systems by applying coding techniques (Shannon–Fano, Huffman) and performance evaluation methods, bridging theoretical knowledge with practical implementation.

Course Outcomes: After learning the contents of this paper the student must 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

List of Experiments

Minimum 12 Experiments to be conducted

All the experiments are to be simulated first using SCILAB/MATLAB/COMMSIM or any other simulation package and then realized in hardware

1. Generate Amplitude modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
2. Generate Frequency modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index
3. Generate modulated and demodulate DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically
4. Generate and demodulate SSB-SC modulated Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate theoretically and practically the modulation index in each case
5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting at least 4 different signals simultaneously with respect to time and recovering without distortion.
6. Verify Sampling theorem for different sampling rates, Sampling types and Duty Cycles and Plot the sampled and reconstructed Signals. Write the conclusions, based on practical observations
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the

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

R25 B.Tech ECE Syllabus					
	ELECTRONIC CIRCUIT ANALYSIS LAB				
II B.Tech – II Sem		**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**
Pre-requisite:					

Course Objectives:

1. To understand and analyze the operation of transistor-based amplifier and oscillator circuits by designing, implementing, and studying their gain, frequency stability, and waveform characteristics.
2. To design and evaluate power amplifier stages (Class A, Class B, push-pull, transformer-coupled) for efficiency, harmonic distortion, and practical limitations in real-world applications.
3. To implement and analyze multivibrator circuits (bistable, astable, monostable, Schmitt trigger, time-base generators) for waveform generation and switching applications.
4. To utilize circuit simulation tools (LTSpice, Multisim, PSpice, Proteus) for virtual experimentation, frequency response analysis, and verification of theoretical concepts.
5. To strengthen circuit design, problem-solving, and analytical skills by correlating hardware measurements with simulation results, preparing students for advanced courses in analog/digital electronics and VLSI circuit design.

Course Outcomes: After learning the contents of this paper the student must 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

List of Experiments

A. Hardware Experiments (7):

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

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

B. Software Simulations (7):

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 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 (±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.)

R25 B.Tech ECE Syllabus				
	LINEAR AND DIGITAL IC APPLICATIONS LAB			
II B.Tech – II Sem	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**
Pre-requisite:				

Course Objectives:

1. To understand the applications of analog integrated circuits by designing and analyzing amplifiers, filters, oscillators, waveform generators, voltage regulators, and modulation/demodulation circuits.
2. To design and implement combinational and sequential digital circuits such as adders, subtractors, encoders, decoders, multiplexers, counters, registers, and memory using standard logic ICs.
3. To develop practical skills in interfacing analog and digital systems by constructing DACs, ADCs, and code converters, and verifying their functionality through truth tables, waveforms, and performance analysis.
4. To enhance circuit design, problem-solving, and experimental verification skills by correlating theoretical concepts with hardware implementation for real-world electronic system design.

Course Outcomes: After learning the contents of this paper the student must 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 various circuits using digital ICs
4. Design and implement ADC, DAC and voltage regulators.

Minimum 12experiments should be conducted

Verify the functionality of the IC in the given application.

List of Experiments

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op-Amp and draw the comparison results of A=B, A<B, A>B
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHz and find the roll off of it.
6. Design a Circuit using IC741 to generate sine / square / triangular wave with period of 1 KHz and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct 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.
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 / Sub the following bits.
    (i) 1010 (ii) 0101 (iii) 1011
    0100 0010 1001.
18. Design a Decade counter and verify its truth table and draw respective waveforms.

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Accredited by NAAC-A Grade, NBA (CSE, ECE & ME) & ISO 9001:2015 Certified

19. Design a Up/downcounterusingIC74163anddrawread/write waveforms.
20. Design a Universal shift register using IC74194 / 195and 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.

R25 B.Tech CSE (AI&ML) Syllabus								
	BASIC ELECTRICAL ENGINEERING							
I B.Tech – I Sem					**L**	**T**	**P**	**C**
					3	**0**	**0**	**3**
Pre-requisite: Mathematics								

Course Objectives:

1. Introduce the fundamental concepts of electrical circuit elements, DC circuit laws, and basic theorems for circuit analysis.
2. Develop an understanding of AC circuit analysis using phasor representation, power calculations, and three-phase systems.
3. Explain the principles, construction, and performance evaluation of transformers.
4. Familiarize students with the construction, operation, and characteristics of DC machines, induction motors, and synchronous generators.
5. Provide knowledge of essential electrical installation components such as LT switchgear, cables, earthing, and batteries.
6. Enable students to perform practical calculations for energy consumption, power factor correction, and battery backup for real-world applications.

Course Outcomes:

1. Apply KVL, KCL, and network theorems (Superposition, Thevenin, Norton) to analyze DC circuits and transient behavior of RL/RC circuits.
2. Analyze single-phase and three-phase AC circuits using phasor representation and determine active, reactive, and apparent power along with resonance conditions.
3. Explain the construction, equivalent circuit, losses, and performance characteristics of single-phase and three-phase transformers.
4. Evaluate the operating principles and performance of DC machines, induction motors, and synchronous generators.
5. Demonstrate the applications of LT switchgear, cables, earthing systems, and batteries in electrical installations.
6. Calculate practical electrical parameters such as energy consumption, power factor improvement, and battery backup for given systems.

UNIT – I: D.C. Circuits

Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT – II: A.C. Circuits

Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections

UNIT – III: Transformers

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT – IV: Electrical Machines

Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single-phase induction motor, Construction and working. Construction and working of synchronous generator

UNIT – V: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

R25 B.Tech CSE (AI&ML) Syllabus								
	ELECTRONIC DEVICES AND CIRCUITS							
I B.Tech – II Sem					**L**	**T**	**P**	**C**
					3	**0**	**0**	**3**
Pre-requisite: 10+2 Physics								

Course Objectives:

1. Introduce the fundamental characteristics and applications of semiconductor diodes and their circuit implementations.
2. Explain the working principles, configurations, and characteristics of Bipolar Junction Transistors (BJTs).
3. Develop an understanding of BJT biasing techniques, operating point stability, and thermal considerations.
4. Analyze transistor amplifiers using small-signal models and h-parameter equivalent circuits.
5. Familiarize students with special-purpose diodes and their applications in electronic circuits.
6. Explore the structure, operation, and characteristics of Field Effect Transistors (FETs), MOSFETs, and advanced nanoscale devices like FinFETs and CNTFETs.

Course Outcomes:

1. Explain the I–V characteristics of semiconductor diodes and their use in rectifiers, clippers, clampers, and voltage regulation.
2. Analyze the operation and characteristics of BJTs in different configurations and extract h-parameters.
3. Apply various BJT biasing techniques to establish a stable operating point and mitigate thermal runaway
4. Evaluate the performance of transistor amplifiers (CE, CB, CC) using small-signal models and h-parameters.
5. Demonstrate the principle and applications of special-purpose diodes such as SCR, tunnel diode, varactor, photodiode, LED, and solar cell.
6. Compare and Contrast FET, MOSFET, FinFET, and CNTFET devices in terms of structure, characteristics, and scaling advantages for modern VLSI.

UNIT – I: Diode Characteristics and Applications

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

UNIT – II: Bipolar Junction Transistor (BJT)

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

UNIT – III: BJT Biasing

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

UNIT – IV: Transistor Amplifiers

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor.

UNIT – V: Special Devices

Special Purpose Diodes: Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar

Cell, LED and Schottky Diode
Field Effect Transistors and Advanced Devices: JFET: Structure, operation, and characteristics
MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics
Advanced Devices: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET

TEXT BOOKS:

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

REFERENCE BOOKS:

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

R25 B.Tech CSE (AI&ML) Syllabus							
COMPUTER ORGANIZATION AND ARCHITECTURE							
II B.Tech – I Sem				**L**	**T**	**P**	**C**
				3	**0**	**0**	**3**
Pre-requisite: Nil							

Course Objectives:

1. Introduce the fundamentals of digital logic, Boolean algebra, and data representation techniques essential for computer system design.
2. Develop the ability to design and analyze combinational and sequential logic circuits required for digital systems
3. Familiarize students with register transfer language, micro-operations, and basic computer organization concepts.
4. Explain the design principles of CPU, instruction sets, addressing modes, and arithmetic operations in computer systems.
5. Provide insights into control unit design using microprogramming and hardwired control techniques.
6. Introduce memory and I/O organization including memory hierarchy, cache, and DMA for efficient data processing.

Course Outcomes:

1. Apply Boolean algebra principles and digital logic to represent data and design basic logic circuits.
2. Analyze combinational and sequential circuits such as adders, multipliers, decoders, counters, and registers.
3. Explain register transfer language, micro-operations, and the basic instruction cycle of a digital computer.
4. Design and Evaluate control unit organization using microprogrammed and hardwired approaches.
5. Demonstrate the organization of CPU, instruction formats, addressing modes, and arithmetic algorithms for efficient computation.
6. Differentiate various memory and I/O organization techniques including cache, DMA, and interrupt handling mechanisms.

UNIT – I:

Boolean Algebra and Logic Gates: Binary codes, Binary Storage and Registers, Binary logic. Digital logic gates.
Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation
Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

UNIT – II:

Combinational Logic: Combinational Circuits, Analysis procedure Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, magnitude comparator, Decoders, Encoders, Multiplexers, HDL for combinational circuits.
Sequential Logic: Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, state Reduction and Assignment, Design Procedure. Registers, shift Registers, Ripple counters, synchronous counters, other counters.

UNIT – III:

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

UNIT – IV:

Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations

UNIT – V:

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory

TEXT BOOKS:

1. Digital Design – M. Morris Mano, Third Edition, Pearson/PHI
2. Computer System Architecture – M. Morris Mano, Third Edition, Pearson/PHI

REFERENCE BOOKS:

1. Switching and Finite Automata Theory, ZVI. Kohavi, Tata Mc Graw Hill
2. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, 5th Edition, McGraw Hill.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson

R25 B.Tech CSE (AI&ML) Syllabus

BASIC ELECTRICAL ENGINEERING LAB

	L	T	P	C
I B.Tech – I Sem	3	0	0	3
Pre-requisite: Mathematics				

Course Objectives:

1. Provide hands-on experience in verifying basic electrical laws (KVL, KCL) and theorems (Thevenin, Norton, Superposition).
2. Develop practical skills to analyze DC transients and AC resonance phenomena in RLC circuits.
3. Familiarize students with the performance evaluation of single-phase transformers through voltage, current, efficiency, and regulation tests.
4. Demonstrate the characteristics of DC and AC machines, including DC shunt motors, three-phase induction motors, and alternators.
5. Train students in experimental measurement of electrical quantities such as voltage, current, active power, reactive power, and impedance.
6. Strengthen the ability to apply theoretical concepts of Basic Electrical Engineering to real-world systems through laboratory practice.

Course Outcomes:

1. Verify KVL, KCL, and network theorems (Thevenin, Norton, and Superposition) experimentally.
2. Analyze the transient response of RL/RC circuits and resonance behavior in RLC circuits.
3. Determine impedance, current, and power in AC series circuits (RL, RC, RLC) using experimental methods
4. Evaluate the voltage, current, efficiency, and regulation characteristics of single-phase and three-phase transformers.
5. Examine the performance characteristics of rotating machines such as DC shunt motors, induction motors, and alternators.
6. Measure and Interpret active and reactive power in balanced three-phase systems using practical setups.

PART - A: Compulsory

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor

PART - B: Minimum Two experiments from the given list

1. Verification of Superposition theorem
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit
5. No-Load Characteristics of a Three-phase Alternator