Detailed Syllabus of B Tech (CORE)

For batches admitted in 2023 and onwards

(3rd - 8th semester)

Vetted in

8th Board of Studies

of

Department of

"Electronics and Communication Engineering"

ISLAMIC UNIVERSITY OF SCIENCE AND TECHNOLOGY

AWANTIPORA, J&K, INDIA-192122

HIGHLIGHTS:

- As per ACITE a minimum of **164** credits (with a minor allowed variation) is to be earned for the completion of B. Tech programme in ECE.
- **Industrial training** (Audit Course) of at least 4 weeks to be taken up at the end of 5th semester (Autumn session). Evaluation will be done in the 6th semester along with courses offered in 6th semester (spring session).
- **Seminar** (in 6th semester) also to be taken as an audit course.
- It is necessary to complete at least 8 credits of *"Open electives",* 8 credits of *"Discipline Centric Electives"* and 6 credits of *"Generic Electives"* during the B. Tech Programme (ECE) in addition to the core and fundamental subjects.
- Open Elective can be a 2-credit course only.
- A student will be eligible to get Under Graduate Degree with **"Honors"** (within ECE) or an additional **"Minor Degree"** (from any other department with SoET, other than ECE), if he/she earns an additional 18 - 20 credits (*as per university order **No: IUST DAA/Acad/23/1381, dated 13-07-2023***), which should be acquired through opting for specialized courses through offline/online (MOOCS) platforms. A CGPA of ≥ 7.5 (as approved in earlier BoS (2018) and consequently approved by Academic Council) should be scored for the award of Honors/ Minor.
- Students interested in pursuing an Honors/Minor Degree have the option to enroll in the Specialization courses. Starting from the third semester onwards, students may enroll in one course per semester as an extra course for the award of Honors/Minor.
- Honors is available to students in the ECE (parent department), while Minor is open to students in sister departments of SOET. Additionally, ECE students interested in pursuing a Minor have the opportunity to choose from available options in other sister department.

- **Discipline Centric** electives are offered to the students of the Department of Electronics and Communication Engineering only. **9 credits** of Discipline Centric electives to be completed during the B. Tech programme
- **Generic electives** are offered to the students of Department of Electronics and Communication Engineering by all other department of School of Engineering and Technology including the Department of Electronics and Communication Engineering. **6 credits** of Generic electives to be completed during the B. Tech programme.
- **Open electives** are offered to the students of Department of Electronics and Communication Engineering by Department outside School of Technology. **8 credits** of Open electives to be completed during the B. Tech programme (ECE)

For batches admitted in 2023 and onwards

Semester-III

S. No	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 201C	Semiconductor Devices	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE202C	Digital Electronics and Logic Design	**3**	**0**	**0**	**0**	**3**	**3**
3.	ECE203C	Signals and Systems	**3**	**0**	**0**	**0**	**3**	**3**
4.	ECE204C	Network Theory	**3**	**0**	**0**	**0**	**3**	**3**
5.	MTH203C	Applied Mathematics for Engineers	**3**	**0**	**0**	**0**	**3**	**3**
6.	ECE 210C	Semiconductor Devices Lab	**0**	**0**	**2**	**0**	**2**	**1**
7.	ECE211C	Digital Electronics and Logic Design Lab	**0**	**0**	**2**	**0**	**2**	**1**
8.	ECE 213C	Network Theory Lab	**0**	**0**	**2**	**0**	**2**	**1**
9.	-	Open Elective	**-**	**-**	**-**	**-**	**2**	**2**
	Total Credits							**20**

Specialization I

S. No	Semester	Course Code	Course Title		L	T	P	S	Hours Per Week	Credits	Mode
			Minor	Honors							
1	3rd	ECE 201S	Electronic Materials and Device Physics	Electronic Materials and Device Physics	3	0	0	1	4	4	Offline

For batches admitted in 2023 and onwards

Semester -IV

S. No	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 250C	Analog Circuits I	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE 251C	Analog Communication	**3**	**0**	**0**	**0**	**3**	**3**
3.	ECE 252C	Electromagnetic Waves	**3**	**0**	**0**	**0**	**3**	**3**
4.	ELE 250C	Control Systems	**3**	**0**	**0**	**0**	**3**	**3**
5.	ECE 253C	Microprocessors and Microcontrollers	**3**	**0**	**0**	**0**	**3**	**3**
6.	ECE 260C	Analog Circuits I Lab	**0**	**0**	**2**	**0**	**2**	**1**
7.	ECE 261C	Analog Communication Lab	**0**	**0**	**2**	**0**	**2**	**1**
8.	ECE 262C	Microprocessors and Microcontrollers Lab	**0**	**0**	**2**	**0**	**2**	**1**
9.	-	Open Elective	-	-	-	-	**2**	**2**
	Total Credits							**20**

Specialization II

S. No	Semester	Course Code	Course Title		L	T	P	S	Hours Per Week	Credits	Mode
			Minor	Honors							
2	4th	ECE 251S	Digital Logic Design using VHDL and Verilog	Digital Logic Design using VHDL and Verilog	2	0	2	-	3	3	Offline

Semester-V

S. No	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 301C	Analog Circuits II	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE 302C	Digital Communication	**3**	**0**	**0**	**0**	**3**	**3**
3.	ECE 303C	Transmission Lines, Antenna and Wave Propagation	**3**	**0**	**0**	**0**	**3**	**3**
5.	ELE 301C	Electrical Machines	**3**	**0**	**0**	**0**	**3**	**3**
6.	ECE xxxE	Elective-I (Discipline Centric)	**3**	**0**	**0**	**0**	**3**	**3**
7.	ECE 310C	Analog Circuits II Lab	**0**	**0**	**2**	**0**	**2**	**1**
8.	ECE 311C	Digital Communication Lab	**0**	**0**	**2**	**0**	**2**	**1**
9.	ECE 312C	Transmission Lines, Antenna and Wave Propagation Lab	**0**	**0**	**2**	**0**	**2**	**1**
10.	ELE xxx C	Electrical Machines Lab	**0**	**0**	**2**	**0**	**2**	**1**
11.	-	Open Elective	**-**	**-**	**-**	**-**	**2**	**2**
	Total Credits							**21**

Specialization III

S. No	Semester	Course Code	Course Title		L	T	P	S	Hours Per Week	Credits	Mode
			Minor	Honors							
1.	5th	ECE 301S *ECE 303S	VLSI Design	*Advanced Digital Design	3	0	0	-	3	3	Offline

List of Discipline Centric Electives for 5th semester

S. No.	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 303E	Random Processes and Noise	3	0	0	0	3	3
2.	ECE 310E	Data Communication	3	0	0	1	3	3
3.	ECE 354E	MATLAB	3	0	0	0	3	3
4.	ECE 350E	Information Theory and Coding	3	0	0	0	3	3
5.	ECE xxxE	Probability and Statistics	3	0	0	0	3	3

For batches admitted in 2023 and onwards

Semester- VI

S. No	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 351C	Digital Signal Processing	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE 352C	VLSI Design	**3**	**0**	**0**	**0**	**3**	**3**
3.	ECE 353 C	Electronic Instruments and Measurements	**3**	**0**	**0**	**0**	**3**	**3**
4.	ELE xxxC	Power Systems	**3**	**0**	**0**	**0**	**3**	**3**
5.	XXX xxxG	Elective-II (Generic)	**3**	**0**	**0**	**0**	**3**	**3**
6.	ECE xxxE	Elective-III (Discipline Centric)	**3**	**0**	**0**	**0**	**3**	**3**
7.	ECE 361C	VLSI Design Lab	**0**	**0**	**2**	**0**	**2**	**1**
8.	ECE 362C	Seminar	**0**	**0**	**2**	**0**	**2**	**1**
9.	ECE 313C	Industrial Training	**-**	**-**	**2**	**0**	**4**	**2**
10.	-	Open Elective	**-**	**-**	**-**	**-**	**2**	**2**
	Total Credits							**24**

Specialization IV

S. No	Semester	Course Code	Course Title		L	T	P	S	Hours Per Week	Credits	Mode
			Minor	Honors							
1.	6th	ECE 302S/ ECE 351S	Organic Electronics/ VLSI Technology	Organic Electronics/ VLSI Technology	3	0	0	1	4	4	Offline

Discipline Centric Electives for 6th semester

S. No.	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 302E	VLSI Technology	3	0	0	0	3	3
2.	ECE 301E	EDA Tools	3	0	0	0	3	3
3.	ECE 355E	Physics of Semiconductor Devices	3	0	0	1	3	3
4.	ECE 358E	System Design	3	0	0	0	3	3

Generic Electives for 6th semester

S. No.	Course	Course Title	Hours Per Week	Total	Credits

	Code		L	T	P	S	Contact Hours	
1.	ECE 351G	Optimization Techniques	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE 403G	Digital Image Processing	**3**	**0**	**2**	**0**	**3**	**3**
3.	ECE 353E	Computer Networks	**3**	**0**	**0**	**0**	3	3

Semester-VII

S. No	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 401C	Wireless Communication	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE 402C	Microwave Engineering	**3**	**0**	**0**	**0**	**3**	**3**
3.	ECE 403C	Power Electronics	**3**	**0**	**0**	**0**	**3**	**3**
4.	-	Elective-IV (Generic)	**x**	**0**	**0**	**0**	**x**	**3**
5.	ECE 411C	Microwave Engineering Lab	**0**	**0**	**2**	**0**	**2**	**1**
6.	ECE 413C	Power Electronics Lab	**0**	**0**	**2**	**0**	**2**	**1**
7.	ECE 412C	Major Project (Stage I)	**0**	**0**	**5**	**0**	**10**	**5**
	Total Credits							**19**

Specialization V

S. No	Semester	Course Code	Course Title		L	T	P	S	Hours Per Week	Credits	Mode
			Minor	Honors							
1.	7th	ECE 401S	RF Design/ Relevant MOOCS Course	RF Design / Relevant MOOCS Course	3	0	0	0	3	3	Offline/ MOOCS

Generic Electives for 7th semester

S. No.	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 452G	Process Control Instrumentation	**3**	**0**	**0**	**0**	**3**	**3**
2.	ECE 456G	Radar Systems	**3**	**0**	**0**	**0**	**3**	**3**
	ECE452G	Wireless sensor Networks	**3**	**0**	**0**	**0**	**3**	**3**

3.	ECE 450G	Artificial Neural Networks And Fuzzy Logic	**3**	**0**	**2**	**0**	**3**	**3**

Semester-VIII

S. No	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 450C	Optical Fiber Communication	**3**	**0**	**0**	**0**	**3**	**3**
2.	XXX xxxC	Engineering Entrepreneurship	**3**	**0**	**0**	**1**	**3**	**3**
3.	ECE xxxE	Elective-V (Discipline Centric)	**3**	**0**	**0**	**-**	**3**	**3**
4.	-	Elective-VI (Generic)	**x**	**0**	**0**	**-**	**x**	**3**
5.	ECE 460C	Optical Fiber Communication Lab	**0**	**0**	**2**	**0**	**2**	**1**
6.	ECE 461C	Major Project (Stage II)	**0**	**0**	**9**	**0**	**18**	**9**
	Total Credits							**19**

Specialization VI

S.No	Semester	Course Code	Course Title		L	T	P	S	Hours Per Week	Credits	Mode
			Minor	Honors							
1.	8th	ECE 451S	Analog CMOS Integrated Circuits	Analog CMOS Integrated Circuits	4	0	0	0	3	3	Offline

Discipline Centric Electives for 8th semester

S. No.	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
2.	ECE 407E	Op Amps and Linear Integrated Circuits	3	0	0	0	3	3
3.	ECE 405E	Mobile Ad hoc Networks	3	0	0	0	3	3
5.	ECE 451E	Organic Electronics	3	0	0	0	3	3
6.	ECE 404E	Photovoltaic System Design	3	0	0	0	3	3

Generic Electives for 8th semester

S. No.	Course Code	Course Title	Hours Per Week				Total Contact Hours	Credits
			L	T	P	S		
1.	ECE 402G	Internet of Things(IoT)	**2**	**0**	**2**	**0**	**3**	**3**

	ECE 407G	Multimedia Technology	**3**	**0**	**3**	**1**	**3**	**3**
2.	ECE 453G	Cyber Forensics	**3**	**0**	**0**	**0**	**3**	**3**
3.	ECE 454G	Network Security	**3**	**0**	**0**	**0**	**3**	**3**
4.	ECE 458G	Python	**2**	**0**	**2**	**0**	**3**	**3**

DETAILED SYLLABUS

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE 201C	Semiconductor Devices	3-0-0-0

COURSE OBJECTIVES: The course is aimed to provide a detailed explanation on construction and working of various semiconductor devices used in modern day solid state electronics. This course will enable students to understand the principles of semiconductor Physics used for construction of semiconductor based devices. The course will also provide students with an understanding of the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

COURSE OUTCOMES (COs):

CO1	Describe the properties of materials and Application of semiconductor electronics
CO2	Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
CO3	Demonstrate the switching and amplification Application of the semiconductor devices
CO4	Differentiate the structures and working principle of Electronic switches like UJT, BJT, MOSFET etc..

UNIT I-Semiconductor Physics: Review of quantum mechanics and review of crystal structure of semiconductors, Intrinsic and Extrinsic semiconductors, carrier statistics and thermal equilibrium carrier concentration, energy bands in intrinsic and extrinsic semiconductors, carrier transport by drift and diffusion, carrier generation and recombination, Poisson and Continuity equation.

UNIT II- *Pn* Junction: Basic structure, pn junction under zero, forward and reverse bias, built-in potential barrier, electric field and space charge width, junction capacitance, charge flow in a pn junction, current-voltage relationship, minority carrier distribution, dynamic behavior under small and large signals, breakdown mechanisms(qualitative), small-signal equivalent circuit, charge storage and diode transients, metal-semiconductor junctions, ohmic contacts, Zener diode and its VI characteristics, Tunnel diode and its VI characteristics.

UNIT III- Bipolar Transistor: Basic structure and principle of operation, modes of operation, static IV characteristics in active and saturation modes, amplification, minority carrier distribution, emitter efficiency, transport factor, current gain, non-ideal effects, small signal model and frequency limitations.

UNIT IV- MOS Field Effect Transistor: Introduction to MOS, types of MOSFET, Construction, Working, Modes of operation, MOSFET as a switch.

UNIT V- Optoelectronic Devices: Optoelectronic devices in daily life, direct and indirect bandgaps, optical absorption, Photodiodes, pn Junction Solar Cell, open circuit voltage and short circuit current, Light Emitting Diodes, introduction to Laser Diodes, pin photodetectors.

TEXT BOOKS:

1. Neamen D.A. and Biswas D, Semiconductor Physics and Devices, McGraw Hill Education

REFERENCE BOOKS:

1. Streetman B.G.andBanerjeeS.K.,SolidStateElectronicDevices,PearsonEducation.

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 202C	**Digital Electronics and Logic Design**	**3-0-0-0**

COURSE OBJECTIVE: The objective of this course is to provide the fundamental concepts associated with digital logic and circuit design. To introduce the basic concepts and laws involved in the Boolean algebra and logic families and digital circuits.

COURSE OUTCOMES (COs):

CO1	Various number systems and conversion from one number system to another.
CO2	Boolean algebra, realization of Boolean functions using basic and universal gates.
CO3	Analyze different combinational and sequential circuits.
CO4	Introduction to PLAs and field programmable gate arrays.
CO5	Understanding of Logic families and their characteristics.

UNIT I- Number System and Boolean Algebra: Number Systems and Codes: Binary, octal, and hexa decimal number systems, binary arithmetic, binary codes, excess-3 code, gray code, error detection and correction codes. Boolean algebra: Postulates and theorems, logic functions, minimization of Boolean functions using algebraic, Karnaugh map and Quine–Mc Clausky methods, realization using logic gates.

UNIT II- Combinational Circuits: Introduction to combinational circuits, realization of basic combinational functions like Adder, Subtractor, Encoder/Decoder, Multiplexer, Comparators, delays and hazards in combinational circuits, Code converters – Implementation using MUX and ROM.

UNIT III- Sequential Circuits: Flip-Flops: SR, JK, T, D, Master/Slave FF, triggering of FF, Analysis of clocked sequential circuits-their design, state minimization, state assignment, circuit implementation, Registers: shift registers, inter-conversion of shift registers, Counters.

UNIT IV- Programmable Logic Devices and Memory: PLAs, PALs and their applications; Sequential PLDs and their applications; State-machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs). Read-only memory, read/write memory – SRAM and DRAM.

UNIT V- Logic Families: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, RTL, DCTL, HTL,ECL, CMOS families and their interfacing

TEXT BOOKS:

1. Mano M., Digital logic and Computer Design, Prentice Hall India
2. Jain R.P., Modern Digital Electronics, Tata McGraw Hill

REFERENCE BOOKS:

1. Floyd T.L., Digital Fundamentals, Charles E. Merrill Publishing Company

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE 203C	Signals and System	3-0-0-0

COURSE OBJECTIVE:- To expose students to different types of signals and systems (especially LTI systems), including different transformation techniques to apply and analyze different real-life periodic and aperiodic signals.

COURSE OUTCOMES (COs):

CO1	Acquiring knowledge about signals, systems and their classification
CO2	Study of the application of Fourier analysis on signals
CO3	Laplace transform analysis and its application to signals and systems
CO4	Z-transform analysis and its application vis-à-vis other analyzing tools

UNIT I- Introduction: Definition of Signals, Classification of Signals, Elementary Signals, Operations on Signals, Definition of Systems, Classification of Systems, Interconnection of Systems, Introduction to LTI Systems, Convolution Sum and Integral, Properties of LTI Systems.

UNIT II- Laplace Transform: Introduction and Definition, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Properties of Laplace Transform, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, The Unilateral Laplace Transform, Solution of differential equations using Laplace transform.

UNIT III- Z-Transform: Introduction and Definition, Region of Convergence for Z-Transforms, Inverse Z-Transform, Properties of Z-Transform, Analysis and Characterization of LTI Systems Using Z-Transform, System Function Algebra and Block Diagram Representations, Unilateral Z-Transform, Solution of difference equations using Z-transform.

UNIT IV- Fourier Series:FourierSeriesRepresentationofContinuous-TimePeriodicSignals, Convergence of the Fourier Series, Properties of Continuous-Time Fourier Series, Fourier Series Representation of Discrete-Time Periodic Signal, Properties of Discrete-Time Fourier Series, Fourier Series and LTI Systems, Continuous and Discrete-Time Filters Described by Differential Equations.

UNIT V- Fourier Transform: Continuous-Time Fourier Transform, Properties of the Continuous-Time Fourier Transform, Convolution Property, Systems Characterized by Linear Constant-Coefficient Differential Equations, Discrete-Time Fourier Transform, Properties of the Discrete-Time Fourier Transform, Duality in Fourier Series and Fourier Transform.

TEXT BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid"Signals and Systems" Pearson Education, 2015.
2. Simon Haykin, Barry Van Veen "Signals and Systems" John Wiley and Sons,2007.

REFERENCE BOOKS:

1. Hwei Hsu "Schaum's Outline of Signals and Systems"McGraw-Hill,2013.
2. P Ramakrishna Rao, Signals and Systems, McGraw-Hill Education.

E-RESOURCES: https://archive.nptel.ac.in/courses/108/104/108104100/, https://nptel.ac.in/courses/108106163

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 204C	**Network Theory**	**3-0-0-0**

COURSE OBJECTIVE: Understand the concepts of basic circuit laws, mesh and Nodal analysis of circuits and circuit theorems. Apply the knowledge of basic circuit law to simplify the networks using network theorems.

COURSE OUTCOMES (COs)

CO1	Solve network problems using mesh current and node voltage equations
CO2	Design filter circuits for given bandwidth/cutoff requirement
CO3	Compute responses of first order and second order networks using time domain/frequency analysis
CO4	Obtain circuit response using Laplace Transform
CO5	Analyze networks using Thevenin, Norton, Maximum power transfer, Superposition, Miller and Tellegen's theorems

UNIT I- Basic Concepts: Basic circuit solving Techniques-KVL, KCL, Voltage Division Rule, Current Division Rule, Practical sources, Source transformations, Network reduction using Star – Delta transformation, graph theory of circuit's, Loop and node analysis, Concepts of super node and super mesh, basics of magnetic circuits.

UNIT II- Review of Network Theorems: Superposition Theorem, Thevenin's and Norton's theorems, Reciprocity, Millman's theorem, Maximum Power transfer theorem, Tellegan's theorem.

UNIT III- Transient and Steady State Behaviour: Behaviour of RL, RC, RLC-circuits under switching conditions and evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. Conditions for transient free networks. Steady state response using Laplace transform, state space approach.

UNIT IV- Resonant Circuits: Concept of Impedance, Admittance, Power/Impedance Triangle, Active/Reactive Power, Series and Parallel Resonance, frequency- response of series and Parallel circuits, Q–Factor, Bandwidth. Low pass and High pass RC and RL circuits.

UNIT V- Two port Networks: Definition of Z, Y, h and T-parameters, modelling with these parameters, relationship between parameters.

TEXT BOOKS:

1. Network Analysis by M. E. Van Valkenber
2. Networks and Systems by D. Roy Choudhury

REFERENCE BOOKS:

1. Circuit theory by F. F. Kuo
2. Fundamentals of Electric Circuits by A. K. Alexander and M. N. O. Saidko
3. Engineering Circuit Analysis by W. H. Hayt, S. M. Durbin and J. Kemmerly.

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Course Code:	Course Title:	L-T-P-S
ECE 203C	Applied Mathematics for Engineers	3-0-0-0

COURSE OBJECTIVE: The course is aimed to develop the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.

COURSE OUTCOMES (COs)

CO1	Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
CO2	Understand the basics of transformations and be able to apply the methods from these subjects in problem solving.
CO3	To have ability of understanding the trigonometric series and hence expansion of the functions in Fourier series.
CO4	Modelling real world problems using Laplace / Fourier transforms.

UNIT I- Laplace Transform: Shifting theorem, Laplace transforms of derivatives and integrals, Heaviside's unit function. Dirac Delta function and its Laplace transforms. Laplace transforms of periodic functions, Heaviside's expansion theorem. Initial and final value theorems. Convolution theorem and its applications, use of Laplace transforms in the solution of linear differential equations.

UNIT II- Fourier Transform: Fourier sine and cosine transform. Fourier integral formula and its applications to solution of boundary value problems.

UNIT III- Series Solution of ODE: Bessel's function, Recurrence relations, Legendre polynomial, Rodrigues formula, Recurrence relations

UNIT IV- Complex Analysis: Complex variables, analytic functions, Cauchy Riemann equations. Complex integration, Cauchy's fundamental theorem, Cauchy's integral formula, Cauchy's inequality and Liouville's theorem on integral function.

UNIT V- Expansions and Seriesin Calculus: Taylor's & Laurent's expansions, Zeros & poles of analytic functions, Residues. Fourier series, Harmonic analysis.

TEXT BOOKS:

1. Saff E.B., Snider A.D., Fundamentals of Complex Analysis for Mathematics, Science, and Engineering, Prentice Hall India, NewDelhi.
2. Spiegel Laplace Transforms, Schaum Series.

REFERENCE BOOKS:

1. Churchill R.V., Complex variables and applications, McGraw Hill Education(India).
2. Snedden N., Theuse of Integral Transforms, McGraw Hill Education (India).

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE 210C	Semiconductor Devices Lab	0-0-0-2

List of Experiments:

1. Steady State Characteristics of pn junction under different bias conditions
2. Study of Zener Diode IV characteristics
3. Zener diode as voltage regulator
4. Characteristics of LED with different wavelengths
5. Small signal and large signal behavior of diodes.
6. Static IV characteristics of bi-polar transistors.
7. Static IV characteristics of MOSFETs
8. MOSFET as Switch.
9. Small signal behavior of bi-polar transistors
10. Study of Solar cell.
11. Simulation experiments using PSPICE or Multisim

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 211C	**Digital Electronics and Logic Design Lab**	**0-0-0-2**

List of Experiments:

1. To realize the truth table of different logic gate
2. To realize half-adder and verify its truth table
3. To realize full-adder and verify its truth table
4. To realize half subtractor and verify its truth table
5. To realize full subtractor and verify its truth table
6. To design multiplexer using 2 input NAND gates
7. To design demultiplexer using 2 input NAND gates
8. To realize flip flops
9. To realize ripple counters
10. Circuit implementation using MUX and ROM

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 212C	**Network Theory Lab**	**0-0-0-2**

List of Experiments*:*

1. Familiarity with lab equipments like multimeter, ammeter, voltmeter, breadboard, CRO, power supplies, etc.
2. Familiarity with electrical/electronic components like resistors, inductors, capacitors, diodes, LEDs, etc.
3. Colour coding of resistors
4. Series and parallel combination of resistors.
5. Verification of OhmsLaw, Kirchoff's Laws.
6. Voltage divider and current dividers.
7. Verification of Superposition Theorem.
8. Verification of Thevenin and Norton Theorems.
9. Verification of Maximum Power Transfer Theorem.
10. Hands on soldering and desoldering techniques

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 250C	**Analog Circuits I**	**3-0-0-0**

COURSE OBJECTIVE: The course is aimed to expose the students with the use of analog circuit analysis techniques to analyze the operation and behavior of various analog integrated circuits. The course starts with basic circuit components and circuit concepts and then gradually moves to practical building blocks of analog electronic systems. The course, exposes students to a serious attempt of making a balance between theory and practice so that the discussed circuits can be constructed in an undergraduate level laboratory class. The course is aimed to teach both BJT based circuits and MOSFET based circuits parallel so that similarities and performance differences between these two classes of circuits are understandable. The analysis of the MOSFET based circuits is aimed to provide the necessary foundation foursome advanced courses e.g Analog VLSI circuit/system design.

COURSE OUTCOMES (COs):

CO1	Comprehensive understanding of electronic devices and circuits.
CO2	Understand the operation and applications of BJTs, FETs and MOSFETs.
CO3	Design and analysis of CE, CB, CC amplifiers using small signal h-model and pi- model
CO4	Performance analysis of basic class-A, class-B, class AB and class-D power amplifiers.

UNIT I- Basic Diode Circuits: Circuit models, graphical and iterative analysis, load line analysis, rectifier circuits, voltage regulation, limiting circuits, level shifters.

UNIT II- Basic BJT and MOSFET circuits: Brief view of structure and operation, IV characteristics, Equivalent circuit models, Analysis of BJT circuits at DC, Analysis of MOSFET circuits at DC.

UNIT III- Single Stage Transistor Amplifiers: Basic principles of amplifier design, Voltage Transfer Characteristics(VTC), Linear Amplification, Transistor Biasing, Small Signal Operation and equivalent models, analysis of basic amplifier configurations (CE, CB, CC for BJT and CS, CG, CD for MOSFET), CE amplifier with emitter resistance, CS amplifier with source degeneration, emitter follower.

UNIT IV - Frequency Response of Transistor Amplifiers: Brief overview of poles and zeros in transfer functions and Bode's rules, low frequency response of CE and CS amplifiers, internal capacitive effects and high frequency models for transistors (BJT and MOSFET), high frequency response of CS and CE amplifiers, Miller'sTheorem,opencircuittimeconstantsfordeterminingcutofffrequencies.

UNIT V- Output Stages: Classification of output stages, Class A, Class B, Class AB and Class D output stages; circuit operation, transfer characteristics, power conversion efficiency and power dissipation of each output stage.

TEXT BOOKS:

1. Boylestad R. and Nashelsky L., Electronic DevicesandCircuits, Prentice Hall
2. Neamen D.A., Microelectronics: Circuit Analysis and Design, McGraw Hill Publications

REFERENCEBOOKS:

1. Sedra A.S.and SmithK.C., Microelectronic Circuits, Oxford University Press.
2. Razavi B., Fundamentals of Microelectronics, John Wiley&Sons

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 251C	**Analog Communication**	**3-0-0-0**

COURSE OBJECTIVE:- To understand concepts of analog modulation schemes along with their generation and demodulation methods, including effect of noise on these modulation schemes in communication system

COURSE OUTCOMES (COs):

CO1	To understand basic principles of communication system and Fourier analysis of different signals.
CO2	To understand the need for modulation. To understand the generation, detection of Amplitude Modulation Techniques and also perform the mathematical analysis associated with these techniques.
CO3	To understand the generation, detection of Angle Modulation Techniques and also perform the mathematical analysis associated with these techniques.
CO4	To understand various reception techniques and to understand the pulse modulation techniques.
CO5	To acquire knowledge to understand different sources of noise, classification of noise and noise performance of analog modulation techniques.

UNIT I- Introduction: Introduction to the Communication system, Introduction to signals, classification of signals, some useful signal operations, Dirac Delta Function, Trigonometric Fourier series and exponential Fourier series, Fourier transforms of some useful functions, modulation property of the Fourier transform, Hibert transform, Baseband Representation of Bandpass Signals, signal transmission through a linear system.

UNIT II- Amplitude (Linear) Modulation: Modulation and need for modulation, Amplitude modulation, Spectrum of amplitude modulation, power analysis of AM signal, Standard AM generation, detection using envelop detector. DSB/SC-AM, generation and detection of SSB-SC modulation, Vestigial Side Band AM signal.

UNIT III- Angle (Exponential) Modulation: Types of Angle Modulation, Concept of Instantaneous frequency, Wide band and Narrow band FM, Generation and detection of FM, Generation and detection of PM, Phase-Locked Loop: Nonlinear Model of PLL, Linear Model of PLL, nonlinear effects in FM systems.

UNIT IV- Pulse modulation techniques and different receivers: Frequency division multiplexing (FDM), Tuned radio frequency, heterodyne receiver, image frequency, Pulse modulation techniques-pulse amplitude modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM), Methods of Generation and detection of PAM, PPM, and PWM.

UNIT V- Noise: Definition of noise, sources of noise, noise power, white noise, band limited white noise, signal to noise ratio, SNR of base band communication system, SSB, DSB-SC, Standard AM, SNR of FM, Noise figure, relative performance.

TEXT BOOK:

1. Simon Haykin, "Communication Systems", Wiley India Edition, 2009.

2. Ramakrishna rao "Analog Communication" McGraw Hill Education (1 July 2017)

REFERENCE BOOKS:

1. B. P. Lathi, Z. Ding "Modern Digital and Analog Communication Systems", Oxford University Press, 2010.
2. John G. Proakis, Masoud Salehi "Communication systems engineering" Prentice Hall, 2002.

E-resources:

https://archive.nptel.ac.in/courses/117/105/117105143/
https://archive.nptel.ac.in/courses/108/104/108104091/

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 252C	**Electromagnetic Waves**	**3-0-0-0**

COURSE OBJECTIVE: Understand the basic mathematical concepts related to electromagnetic vector fields

COURSE OUTCOMES (COs):

CO1	Understand basic vector algebra and calculus as mathematical tool for analysis of electric and magnetic fields.
CO2	Recognize and classify the basic Electrostatic theorems, laws, classify the basic magneto static theorems and laws and infer the magnetic properties of matter.
CO3	Summarize the concepts of electrodynamics & to derive and discuss the Maxwell's equations.
CO4	Students are expected to be familiar with Electromagnetic wave propagation in different mediums
CO5	To understand the concept of power flow modelled by pointing vector

UNIT I- Fundamentals of Electromagnetic Analysis: Circuit theory and Field theory, Why study EM waves?, Vector Analysis, differential length element and line integral, differential surface element and surface integral, differential volume element and volume integral, Gradient of scalar, Divergence of vector, Curl of vector, physical interpretation of gradient, divergence and curl, Divergence Theorem, Stoke's Theorem.

UNIT II- Review of Electric and Magnetic Fields: Fundamental relations of electrostatic fields, Coloumbs Law, Gauss's Law, Potential Function, Equipotential surfaces, Electric fields in materials and dielectric constant, poisons and laplace equation, Fundamental Relations of magnetostatic fields, Biot Savarts Law, Ampere Circuital Law, Magnetic Scalar and vector potentials, Magnetic fields in materials and permeability, Magnetic Induction and Faradays Law.

UNIT III- Maxwell's Equations: Equations for electrostatic fields, Equations for magnetostatic fields, Inconsistency of Ampere Circuital Law, Maxwell's equation for time varying fields, equation of continuity for time varying fields, Boundary conditions for electric and magnetic fields.

UNIT IV- Electromagnetic Plane Waves: Solution for free space condition, Uniform plane wave propagation, Uniform plane waves, wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane waves in free space, plane waves in good conductors.

UNIT V- Poynting Vector and the flow of power: Poynting's theorem, Note on interpretation of E × H, Instantaneous, Average and Complex Poynting vector, Power loss in plane conductor, Reflection of plane wave by perfect conductor: normal incidence, reflection of plane wave by perfect dielectric: Normal incidence.

TEXT BOOKS:

1) Sadiku M.N, Elements of Electromagnetics, Oxford university press.

REFERENCE BOOKS:

1) Electromagnetic waves and Radiating Systems by Jordan, Balman, PHI.

2) Electromagnetic Waves by R.K Shevgoankar, Mc Graw Hill.

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ELE250C	**Control Systems**	**3-0-0-0**

COURSE OBJECTIVE: Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

COURSE OUTCOMES (COs):

CO1	State open and closed loop control systems and their mathematical models.
CO2	Transfer functions of linear systems and block diagram reduction technique.
CO3	Time response of the control systems, and stability analysis in terms of root-locus technique and bode plots.
CO4	Design of very basic control systems using controllers.

UNIT I- Introduction to Linear Control Systems: Control systems – examples and classification, open loop and closed loop control systems and their differences, transfer functions, block diagram representation of systems, signal flow graphs – reduction using Mason's gain formula, models of some industrial control devices and systems

UNIT II- Continuous Time System Response and Stability: Standard test signals, time domain performance of first and second order control systems, time domain specifications of these systems, steady state and transient response, steady state errors and error constants, concept of stability, BIBO stability, relation between characteristic equation roots and BIBO stability, Routh Hurwitz stability criterion, relative stability analysis

UNIT III - Root Locus and Frequency Response Analysis: Root locus technique and its construction principles, frequency response and frequency domain specifications, Bode diagrams–determination of stability, phase margin and gain margin from the Bode diagrams, Nyquist methods – determination of stability, phase margin and gain margin from Nyquist diagrams

UNIT IV- Classical Control System Design Methods: Control system design using root locus methods, relationship between root locus and time domain –Cascade (lag, lead, lag-lead, PI, PID) and feedback (PD) compensation using root locus plots, compensator design using Bode plots – Cascade (lag, lead, lag-lead, PI, PID) and feedback(PD) compensation

UNIT V- Control System Analysis using State Variable Analysis: Introduction to state variable representation, conversion of state variable models to transfer functions and vice versa, eigen values and eigen vectors, solution of state equations, properties of state transition matrix.

TEXT BOOKS:

1. Nise N.S., Control Systems Engineering, John Wiley and Sons
2. Gopal M., Control Systems–Principles and Design, Tata McGraw Hill

REFERENCE:

1. Stefani R., Savant C., Shahian B and Hostetter G., Design of Feedback Control Systems, Saunders College Publishing
2. Ogata K., Modern Control Engineering, Prentice Hall India

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 253C	**Microprocessors and Microcontrollers**	**3-0-0-0**

COURSE OBJECTIVE: to provide flexibility, enabling it to perform various functions or tasks (commonly known as general purpose), by executing programmed instructions dictating its operations

COURSE OUTCOMES (COs):

CO1	Identify the difference between the different microprocessors and microcontrollers and can describe the advantages and disadvantages of both.
CO2	Demonstrate the internal architecture, addressing modes and instruction set of different microprocessors, 8085 and 8086
CO3	Illustrate the chips (8255,8155) and their interfacing with 8085.
CO4	Interfacing peripheral devices, Multi-purpose programmable device
CO5	Overview of 8051 Microcontroller family

UNIT I- 8085 pinout diagram, function of different pins, data bus, address bus, multiplexing and demultiplexing of address/data lines, control bus, control and status signals, internal architecture (ALU, Register Array, timing and Control Unit), flags, Different addressing modes, instruction set, arithmetic and logic operations, 8085 assembly language programming, (addition, subtraction, multiplication, Division), timing diagrams, Instruction cycle.

UNIT II- Addressing techniques, memory mapped I/O and I/O mapped I/O scheme, Partial and absolute address decoding, Basic interfacing concepts, interfacing input devices, interfacing output devices, 8085 Interrupts, stack and subroutines, counters and time delays.

UNIT III- 8086 architecture, addressing modes, Instruction set, Basic programming concepts, interrupts.

UNIT IV-Interfacing peripheral devices, Multi-purpose programmable device (8155), Programmable peripheral interface (8255), 8259A programmable interrupt controller, Interfacing 8085 and using 8155 & 8255, with different devices - stepper motor, A/D and D/A converters, Interfacing with LCD.

UNIT V- Overview of 8051 Microcontroller family, Architecture, Basic assembly language programming concepts, The program Counter and ROM Spaces in the 8051, Data types, 8051 Flag Bits ad PSW Register, 8051 Register Banks and Stack. Introduction to 8 bit AVR microcontrollers, ATmega328 Architecture

TEXT BOOKS:

1) Ramesh S Gaonkar, Microprocessor Architecture, Programming and Applications with 8085. PRI Publishing (India) Pvt. Ltd.
2) The 8051 Microcontroller and Embedded Systems, Mazidi and Mazidi, Pearson pub
3) Fundamentals of Microprocessor and Microcontroller by B Ram. Danpath Rai Publications

REFERENCE BOOKS:

1. 8086 Microprocessor and its applications by A. Nagoor Kani, TMG

E- resource: https://onlinecourses.nptel.ac.in/noc24_ee46/preview

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE260C	**Analog Circuits I Lab**	**0-0-0-2**

List of Experiments:

1. Diode rectifier circuits (half-wave and full-wave)
2. Limiter circuits and level shifters using diodes
3. Voltage regulation using zener diodes
4. Design of a DC power supply
5. DC characterization of transistors
6. Design of simple transistor amplifiers
7. Introduction to SPICE design environment

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE261C	**Analog Communication Lab**	**0-0-0-2**

List of Experiments:

1. To realize Amplitude Modulation (AMDSB-FC) and demodulation.
2. To realize Amplitude Modulation (AMDSB-SC) and demodulation.
3. To realize Amplitude Modulation (AMSSB-FC) and demodulation.
4. To realize Frequency Modulation (FM) and demodulation.
5. To realize Pulse Amplitude Modulation (PAM) and demodulation.
6. To realize Pulse Width Modulation (PWM) and demodulation.
7. To realize Pulse Position Modulation (PPM) and demodulation.
8. To realize Pulse Code Modulation (PCM) and demodulation.
9. To study heterodyne receiver.
10. To study Frequency division multiplexing.

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE262C	**Microprocessors and Microcontrollers Lab**	**0-0-0-2**

List of Experiments:

1. Addition/Subtraction using 8085 Kits.
2. Multiplication/Division using 8085 Kits.
3. Introduction to Atmel Studio.
4. Led blinking program using Atmega328/Atmel studio.
5. Generation of various Led Patterns using Atmega328/Atmel studio.
6. Interfacing of switches and taking decisions using Atmega328/Atmel studio.
7. Interfacing of LCD
8. Interfacing of motors
9. Introduction to Arduino board and IDE.
10. Interfacing of various I/O devices with Arduino.

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE301C	**Analog Circuits II**	**3-0-0-0**

COURSE OBJECTIVE: Explain how alternative feedback topologies affect amplifier gain, I/P and O/P impedance and stability. To understand and analyze Differential Amplifiers, Op amps and their applications

COURSE OUTCOMES (COs):

CO1	Characterization and stability of feedback amplifiers.
CO2	Analyze input/output relation for various simple applications of Op-Amp in analog circuits
CO3	Concept of positive feedback and design of an oscillator circuit.
CO4	Understanding of converters and operating principle of 555 based monostable and astable multivibrator.

UNIT I- Feedback Amplifiers: Review of amplifiers, Feedback in amplifiers, General feedback structure, impact of negative feedback on properties of amplifiers (gain, linearity, bandwidth and I/O impedances), feedback topologies (series-shunt, series-series, shunt-series, shunt-shunt), stability in feedback amplifiers(stability criterion, phase and gain margins, frequency compensation),

UNIT II-Differential Amplifiers: Definition, AC and DC analysis, methods for increasing input impedance, large signal analysis and small signal analysis of differential pairs, common mode rejection, Operational amplifier (Op-Amp) and its performance parameters (slew rate, GBW product, operating frequency), Inverting and Non inverting amplifier, voltage follower, integrator and differentiator.

UNIT III- Converters: Instrumentation amplifier, Analog to digital converters (counter, successive approximation, ramp and flash type), Digital to analog converters (binary weighted and R-2R ladder type). 555 timer- architecture and applications (astable and monostable multivibrator).

UNIT IV- Oscillators: Basic principle of sinusoidal oscillators, oscillation criterion, analysis of oscillator circuits, phase shift, Wein Bridge oscillators, LC oscillators, brief discussion on crystal oscillators. Wave-shaping circuits, astable, bistable, monostable multivibrators.

UNIT V- Phase Locked Loop, Frequency Synthesis, Operational Transconductance Amplifiers: Definition, applications, Current sources, current mirrors, Wilson current mirror, Wildar current source, Darlington pair.

TEXT BOOKS:

1. Sedra A.S and Smith K.C., Microelectronic Circuits, Oxford University Press.
2. Razavi B., Fundamentals of Microelectronics, John Wiley & Sons.
3. Operational Amplifiers and Linear Integrated Circuits, Rama Kate GAikward

REFERENCE BOOKS:

1. Boylestad R. and Nashelsky L., Electronic Devices and Circuits, Prentice Hall
2. Neamen D.A., Microelectronics: Circuit Analysis and Design, Mc Graw Hill Publications

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE302C	**Digital Communication**	**3-0-0-0**

COURSE OBJECTIVE: To comprehend and assess the signal flow within a digital communication system. To evaluate the error performance of a digital communication system in the presence of noise and other interferences.

COURSE OUTCOMES (COs):

CO1	Analyze various digital modulation systems.
CO2	Various keying techniques, generation and applications.
CO3	Spread spectrum modulation and related modulation techniques.
CO4	Analyze various source coding and line coding systems.
CO5	Compute band width requirement and probability of error in various digital modulation systems.

UNIT I- Introduction to Digital Communication: Sampling theorem, quantization error, Pulse Code Modulation (PCM), PCM transmitter and receiver, Bandwidth, Differential PCM systems (DPCM), Delta modulation and its drawbacks, Adaptive Delta Modulation, Comparison of PCM and DM systems.

UNIT II- Digital Modulation Techniques: Digital Modulation Techniques, Generation and detection of ASK, FSK,PSK, DPSK, QPSK, QAM, Pulse modulation techniques- Pulse Amplitude Modulation (PAM), Pulse Position Modulation(PPM),Pulse Width Modulation (PWM).

UNIT III- Spread Spectrum Modulation Techniques: Frequency hopping, SS modulation, DSS, FHSS, Hybrid, M-sequences and its properties, Gold sequences, CDMA, OFDM, introduction to convolution analysis

UNIT IV- Error Detection and Control: Error detection and correction techniques: Parity coding, linear block coding, VRC &;HRC, Cyclic Redundancy(CRC),Convolution Codes- Introduction, encoding of convolution codes, time domain approach, transform domain approach, graphical approach-State, Tree and Trellis diagram.

UNIT BV- Transmission of Data: Bit and Baud rate, Channel capacity and Shannon's law, Synchronous and asynchronous transmission, UART, USART, Line encoding, Unipolar encoding, Polar encoding, Bipolar encoding, Manchester encoding.

TEXT BOOKS:

1. Haykin S., Digital Communications, John Wiley and Sons

REFERENCE BOOKS:

1. Proakis J. G. and Salehi M., Digital Communication, McGraw Hill
2. Farouzan. B., Data Communication and Networks.

E RESOURCE: https://nptel.ac.in/courses/108101113

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE303C	**Transmission Lines, Antenna and Wave Propagation**	**3-0-0-0**

COURSE OBJECTIVE: The Course is designed to understand the fundamentals of transmission lines and learn the principles of wave propagation along transmission lines and different propagation environments. Develop an understanding of basic antenna principles including radiation patterns, gain, directivity, impedance and apply transmission line theory to the design and analyze RF/Microwave circuits and systems, explore antenna design techniques and gain hands-on experience.

COURSE OUTCOMES (COs):

CO1	Introduce different types of transmission lines and perform the lumped circuit model analysis of a transmission line and their characteristics.
CO2	Use the smith chart as a graphical tool for solving various transmission line problems.
CO3	Analyze the electric and magnetic field radiations from various basic antennas and mathematical formulation of the analysis.
CO4	To acquire knowledge on the basic parameters considered in the antenna design process
CO5	To understand different types of wave propagation.

UNIT I- Transmission Line Theory: Transmission line general solution, basic definitions, distortion less line, telephone cables, inductance loading, line not terminated in Z_O, reflection, open and short circuited lines, reflection coefficient, parameters of open wire and coaxial lines at radio frequency, standing wave ratio, input impedance of lossless, open wire and short circuited lines, quarter wave lines as impedance transformer, half wave and eight wavelines, impedance matching, Smith Chart and its applications.

UNIT II- Fundamentals of Antennas: Potential functions and electromagnetic field, radiation mechanism, current elements, power radiated by current element, radiation resistance, antenna definition, isotropic radiator. Antenna parameters: Radiation resistance, bandwidth, beamwidth, radiation pattern, radiation intensity, directivity and gain, antenna aperture, efficiency, effective aperture, effective length, polarization.

UNIT III- Special Purpose Antennas: Half wave antenna, vertical antenna above ground, grounded quarter wave antenna, dipole and folded dipole antenna, horn antenna, parabolic antenna, helical antenna, Yagi antenna and microstrip antenna.

UNIT IV- Propagation of Waves: Waves in free space, attenuation, absorption and polarization, effects of environment, ground wave propagation, sky wave propagation, space wave propagation, Tropo-spherical propagation and Extra-terrestrial propagation

TEXT BOOKS:

1. Ryder J.D., Networks, Lines and Fields, Prentice Hall India

REFERENCE BOOKS:

1. Balanis C.A., Antenna Theory: Analysis and Design, John Wiley and Sons
2. Jordan and Balman , Electromagnetic Waves and Radiating Systems, PHI

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ELE301C	**Electrical Machines**	**3-0-0-0**

COURSE OBJECTIVE: Applications which will be utilized in the electrical machines with its performance and theory of operation.

COURSE OUTCOMES (CO'S):

CO1	To obtain the performance characteristics of single phase transformer.
CO2	To obtain the open circuit and load characteristics of self and separately excited dc generator.
CO3	To obtain the performance characteristics of DC compound and DC Shunt motors.
CO4	Principle of operation of induction and synchronous machines.

UNIT -Transformers: Operating principle, classification, construction, EMF equation, phasor diagrams, equivalent circuit model, losses and efficiency, voltage regulation, polarity test, open circuit test, short circuit test, autotransformers

UNIT II- DC Generators: General introduction, principles of operation, construction, types, EMF equation, types of windings, commutation and armature reaction, characteristics of DC generators.

UNIT III- DC Motors: Principles of operation, construction, types, back EMF and torque equation torque and speed, characteristics of various types of DC motors, starting and speed control of DC motors

UNIT IV- Induction Machines: Rotating magnetic field, principle of operation of an induction motor, construction, types, slip, equivalent circuit torque developed in an induction motor, torque/speed characteristics, losses and efficiency, single phase induction motor, double field revolving theory, types of single phase induction motors.

UNIT V- Synchronous Machines: Construction, types and operating principle of synchronous generator, AC armature windings, pitch factor and distribution factor, equivalent circuit, phasor diagrams. O.C.C and S.C.C of a synchronous machine.

TEXT BOOKS:

1. Nagrath and Kothari, Electric Machines, Tata McGraw Hill

REFERENCE BOOKS:

1. Wildi T., Electrical Machines Drives and Power Systems, Pearson Education
2. Chapman, Electric Machinery Fundamentals

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ELE310C	**Analog Circuits II Lab**	**0-0-0-2**

List of Experiments*:*

1. Multivibrator circuits for wave form generation
2. Op Amp as inverting, non-inverting amplifier and voltage follower
3. Integrator & Differentiator
4. Design of RC oscillators (Phase shift & Wein bridge oscillator)
5. 555 timer as astable and monostable multivibrator
6. Realization of Op-Amp as differential amplifier
7. Realization of Op-Amp Instrumentation amplifier
8. Frequency response of transistor amplifiers
9. Design of LC oscillators (Colpitt/Hartley)
10. Simple feedback circuits to demonstrate impact of negative feedback on transistor amplifiers

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ELE311C	**Digital Communication Lab**	**0-0-0-2**

List of Experiments:

1. To realize Pulse Code Modulation (PCM) and Demodulation.
2. To realize Amplitude Shift Keying (ASK) and its demodulation.
3. To realize Frequency Shift Keying (FSK) and its demodulation.
4. To realize Phase Shift Keying (PSK) and its demodulation.
5. Study Quadrature Phase Shift Keying (QPSK).
6. To study sampling technique and aliasing.

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ELE312C	Transmission Lines Antenna and Wave Propagation Lab	0-0-0-2

List of Experiments

1. Determine the primary (R, L, G, C) of a transmission Line
2. To measure the Characteristic Impedance of a Transmission Line
3. Study of stationary waves
4. To study frequency characteristics of a Transmission Line
5. To study the method of evaluation of an unknown load impedance by measuring VSWR and the position of voltage minimum
6. To study gain-radiation characteristics of a simple dipole antenna
7. To study gain radiation characteristics of a horn antenna, folded dipole antenna, different element Yagi Uda antenna
8. To Design a microstrip patch antenna

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ELE 312C	**Electrical Machines Lab**	**0-0-0-2**

List of Experiments:

1. To perform open circuit and short circuit tests on a single-phase transformer.
2. To perform polarity test on a single-phase transformer.
3. To study various parts of a dc machine and draw sketches of the same.
4. To plot the saturation curve of a dc machine.
5. To plot the external characteristics of a separately excited dc generator.
6. Starting of DC motor by using a starter.
7. Speed control of DC series and shunt motor by armature voltage control.
8. To study the different parts of an Induction motor.
9. To determine the Torque-speed characteristics of a 3-phase Induction motor.
10. To Study the construction of a synchronous machine.
11. To obtain the OCC and SCC of a synchronous machine.

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE 351C	Digital Signal Processing	3-0-0-0

COURSE OBJECTIVE: Understand the basic elements and fundamental concepts of digital signal processing, including the concept of frequency in continuous-time and discrete-time signals.

COURSE OUTCOMES (CO's):

CO1	Concept and evolution of digital signal processing and its day-to-day use.
CO2	Discrete Fourier Transform and its use in linear filtering.
CO3	Various filter structures and their implementation.
CO4	Designing of analog and digital filters, comparison and methods.

UNIT I- Introduction: Basic Elements of Digital Signal Processing, Concept of Frequency in Continuous-Time and Discrete-Time Signals, A/D and D/A Conversion, Discrete-Time Signals and Systems, Analysis of Discrete-Time LTI systems, Discrete-Time Systems Described by Difference Equations, Implementation of Discrete-Time Systems.

UNIT II- Discrete Fourier Transform: Introduction and Definition, Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, Discrete Fourier Transform, DFT as a Linear Transformation, Relationship of the DFT to Other Transforms, Properties of the DFT, Linear Filtering Methods Based on the DFT, Frequency Analysis of Signals Using the DFT.

UNIT III- Fast Fourier Transform: Introduction and Definition, Direct Computation of the DFT, Divide-and-Conquer Approach to Computation of the DFT, Radix-2 and Radix-4 FFT Algorithm, Split-Radix FFT Algorithms, Implementation of FFT Algorithms, Applications of FFT Algorithms, Linear Filtering Approach to Computation of the DFT, Quantization Effects in the Computation of the DFT.

UNIT IV- Structures for Discrete Time Systems: Structures for the Realization of Discrete-Time Systems, Structures for IIR Systems, State-Space System Analysis and Structures, Quantization of Filter Coefficients, Round-Off Effects in Digital Filters

UNIT V- Filter Design Techniques: Design of FIR filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method, Design of IIR filters from continuous time filters: Approximation of Derivatives, Impulse Invariance, Bilinear Transformation.

TEXT BOOKS:

1. MitraS.K.,DigitalSignalProcessing:AComputerBasedApproach,TataMcGrawHill

REFERENCE BOOKS:

1.ProakisJ.G.andManolakisD.G.,DigitalSignalProcessing:Principles,AlgorithmsandApplications,PrenticeHall

1. Oppenheim A.V.,SchaferR.W.andBuckJ.R.,DiscreteTimeSignalProcessing,PearsonEducation

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 352C	**VLSI Design**	**3-0-0-0**

COURSE OBJECTIVE: Understand the fundamental principles of MOS and CMOS. Apply theoretical knowledge to practical design tasks, including layout considerations, sizing of transistors, and optimization of circuit performance

COURSE OUTCOMES (CO's):

CO1	Identify the various IC fabrication methods.
CO2	Express the Layout of simple MOS circuit using Lambda based design rules for subsystem design.
CO3	Differentiate various FPGA architectures and design an application using Verilog HDL
CO4	Concepts of modeling a digital system using Hardware Description Language.

UNIT I- MOS Transistor Theory: Review of MOS structure and operation, nMOS, pMOS enhancement transistor, IV characteristics, short channel effects, MOS capacitor, CV characteristics, scaling of MOS transistor, Introduction to CMOS circuits, quality metrics of digital design

UNIT II- CMOS Inverter: Operation of MOS transistor as a switch, CMOS logic, CMOS inverter(pull up and pull down),CMOS inverter static characteristics, noise margin, beta ratio, transistor sizing, switching characteristics of inverter (rise time, fall time, delay time), power consumption, static dissipation, dynamic dissipation

UNIT III- CMOS Logic Design: CMOS logic gate design (NAND and NOR logic), combinational logic, compound gate, ratioed logic, pseudo nMOS inverter, saturated load inverters, pass transistor logic, complementary pass transistor logic, transmission gate, dynamic logic, issues in dynamic design, glitching, cascading dynamic gates, domino logic, charge sharing, Bi-CMOS logic, layout

UNIT IV- Sequential MOS Logic Circuits: Multiplexer, MUX implementation in CMOS and transmission gates, CMOS subsystem design, design and implementation of adder, design methodology, carry ripple adder, carrylookaheadadder,carryskipadder,carryselectadder,dynamicadderdesign,Manchester chain carry adder, transmission gate adder, SR flip-flop, memory elements–SRAM and DRAM cell, latches

UNIT V- CMOS Process Flow: Simplified CMOS process flow, CMOS technology, basic n-well and p-well process

TEXT BOOKS:

1. Weste N.H.E. and Eshranghian K., Principles of CMOS VLSI Design,Wesley Publications

REFERENCE BOOKS:

1. Rabaey J.M., handrakasan A. and Nikolic B., Digital Integrated Circuits: Analysis and Design, McGraw Hill Education

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE 353C	Electronic Instruments and Measurements	3-0-0-0

COURSE OBJECTIVE: The course introduces the principle of operation and construction of basic instruments for measurement of electrical quantities. Measurement of basic circuit parameters by using bridge circuits, sensors and transducers will be discussed. Familiarization with digital measurement systems are also included.

COURSE OUTCOMES (COs):

CO1	To recognize the evolution and history of units and standards in Measurements.
CO2	To identify the various parameters that are measurable in electronic instrumentation.
CO3	To choose appropriate instruments for the measurement of voltage, current in ac and dc.
CO4	To describe the bridge configurations and their applications.
CO5	To Understand the operating principles of basic building blocks of digital systems, recording and display units.

UNIT I- Measurement standards-Units, Dimensions and standards, Errors in measurement-Types of Errors, Need for calibration, Accuracy and precision. Classification of instruments, secondary instruments: indicating, integrating and recording instruments. Analog indicating instruments, essentials of indicating instruments - deflecting, damping, controlling torques. PMMC (permanent magnet moving coil) instruments, moving iron (MI) instruments, electro-dynamic type Wattmeter, Electrostatic type instruments, Induction type instruments.

UNIT II- Bridge Measurements- DC Bridges and their applications: Wheatstone Bridge, Kelvins bridge. AC Bridges and their applications: Maxwell's inductance Bridge, Maxwell's inductance-capacitance Bridge, Hays Bridge, Anderson's Bridge, Owens Bridge, De-Sauty's Bridge, Schering Bridge, Weins Bridge.

UNIT III- Digital Methods of Measurement and the CRO: Counter Timer, Analog to Digital Converters: Flash, Successive Approximation Type, Dual Slope ADC, Digital Multimeter. Introduction to CRO, Oscilloscope block diagram, Cathode Ray Tube, Delay Line, Multiple Trace, Digital Storage Oscilloscope

UNIT IV- Transducers: Electrical transducers selection and considerations, resistive, strain gauges, temperature transducers, platinum resistance type, thermistor, thermocouples, LVDT, piezoelectric, photoelectric transducers

UNIT V- Data Acquisition Systems and Display Devices: Introduction to Data Acquisition Systems, various DAS configurations, data acquisition in PLC, SCADA, Sensors - its various types. Displays – LED, LCD, 7- segment displays

TEXT BOOKS:

1. Cooper W.D. and Helfrick A.D., Electronic Instrumentation and Measurement Techniques, Prentice Hall.

REFERENCE BOOKS:

1. Sawhney A. K., A Course in Electronic Measurements and Instrumentation, Dhanpat Rai and Co.
Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub.

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ELE 350C	**Power Systems**	**3-0-0-0**

COURSE OBJECTIVE: To introduce the concept of power system analysis, stability, operation, and control.

COURSE OUTCOMES:

CO1	Develop the models for power system components under steady state operating condition and represent the power system network by impedance diagram.
CO2	Apply numerical methods to solve the power flow problem
CO3	Determine the performance of power system under balanced and unbalanced faulted condition.
CO4	Analyze the transient behavior of the power system when it is subjected to a fault.
CO5	Apply numerical methods to analyze the stability of the power system

UNIT I- Fundamentals of Power Systems: Introduction to power systems, single line diagram, impedance and reactance diagram, single phase and three phase transmission, overhead and underground transmission system, elements of AC distribution, single fed, double fed and ring main distributor, PU method of representing quantities, PU impedance diagram of a power system

UNIT II- Overhead Line Insulators and Insulated Cables: Types of insulators and their applications, potential distribution over a string of insulators, string efficiency and methods of equalizing potential drop, classification of cables, conductors, insulating materials, insulation resistance, electrostatic stress, grading ofcables,capacitancecalculation,lossesandcurrentcarryingcapacity

UNIT III- Over Transmission Lines: Transmission line parameters, types of overhead conductors with calculations of inductance and capacitance, effect of earth on capacitance of a transmission line, bundled conductors, skin and proximity effect, corona, interference of power lines with communication lines

UNIT IV- Performance of Lines: Representation of lines, modeling and performance analysis of short, medium and long transmission lines, ABCD constants, transposition of transmission conductors, surge impedance loading and Ferrani effect

UNIT V- Fault Analysis: Faults, types of faults, symmetrical components of a three phase system, evaluation of components, three phase power in terms of symmetrical components, sequence impedances, sequencenetworkequations,calculationoffaultcurrentsforunsymmetricalfaults,singlelinetoground,linetoline ,doublelinetogroundfaultsandforsymmetricalthreephasefaults,currentlimitingreactors

TEXT BOOKS:

1. Wadhwa C.L., Electric Power Systems, New Age International

REFERENCE BOOKS:

1. Grainger J.J. and Stevenson W.D., Power System Analysis, McGraw Hill
2. Nagrath and Kothari, Power System Engineering, TataMcGrawHill

For batches admitted in 2023 and onwards

Course Code:	Course Title:	L-T-P-S
ECE 361C	Digital Signal Processing Lab	0-0-0-2

List of Experiments :

1. Realization of sampling theorem for a given CTS.
2. To find DFT/IDFT of given DT signal
3. Implementation of FFT of given sequence (Radix 2 and Radix 4)
4. Implementation of LP FIR filter for a given sequence
5. Implementation of HP FIR filter for a given sequence
6. Implementation of LP IIR filter for a given sequence
7. Implementation of HP IIR filter for a given sequence
8. Implementation of windowing techniques (Rectangular and Kaiser)

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 362C	**VLSI Design Lab**	**0-0-0-2**

List of Experiments*:*

1. Study of simulation tools
2. Design entry and simulation of combinational logic circuits
3. Design entry and simulation of sequential logic circuits
4. Schematic entry and SPICE simulation for CMOS inverter
5. Automatic layout generation

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 401C	**Wireless Communication**	**3-0-0-0**

COURSE OBJECTIVE: The Course is designed to understand the basic principles of wireless communication systems, learn about the characteristics of wireless channels, analyze and model wireless channels using tools like path loss models and understand the effects of propagation phenomena. The course will also help students to gain practical experience in designing and optimizing wireless communication systems to meet specific performance requirements.

COURSE OUTCOMES (COs):

CO1	Different wireless communication systems and their components.
CO2	Characteristics of wireless channel and propagation path loss models.
CO3	Different multiple access techniques in cellular Communication.
CO4	Different standards of cellular network, WLAN family and wireless broadband networks.
CO5	Functionalities of mobile network layer, transport layer and fundamental concepts of mobile internet Protocol

UNIT I- Introduction: Wireless Communication Systems, Advantages and challenges of Wireless communication, Classification of Wireless Systems, Evolution of mobile radio communication, Performance parameters in wireless communication, Spectrum limitations and standards.

UNIT II- Introduction to the cellular concepts: System design fundamentals, Frequency Reuse, channel assignment strategies, Hand-off strategies, Interference & system capacity, Improving Coverage & capacity in cellular systems (Cell Splitting and Sectoring), Introduction to radio-wave propagation, Large-scale path loss, small-scale fading & its types, Multipath Fading.

UNIT III- Review of basic modulation techniques: Nyquist Criterion for ISI cancellation, Radio propagation mechanisms, Propagation effects with mobile radio, Structure of wireless communication link.

UNIT IV- Spread Spectrum Systems: PN Sequence and its generation, Direct Sequence SS, Frequency Hopping Spread spectrum (FHSS), Time Hopping Spread Spectrum (THSS), Hybrid Spread Spectrum, FDMA, TDMA, CDMA Systems, Orthogonal Frequency Division Multiplexing.

UNIT V- Recent Trends in Wireless Communication: UWB, MIMO, 4G and 5G, Internet of Things. Introduction to Cognitive Radio

TEXT BOOKS:

1. Wireless communication, Principles & Practices (2nd edition) T.S Rapport, Prentice Hall, 2002.

REFERENCE BOOKS:

1. Andreas. F. Molisch , ―Wireless Communications, John Wiley –India, 2006.
2. Simon Haykin& Michael Moher, ―Modern Wireless Communications, Pearson Education, 2007.
3. Wireless Communications and Networking, J. W. Mark & W. Zhuang, Prentice Hall India, 2006

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 402C	**Microwave Engineering**	**3-0-0-0**

COURSE OBJECTIVE: comprehensive understanding of Microwave Engineering principles and applications, enabling them to design, analyze, and optimize microwave systems for various communication and radar applications.

COURSE OUTCOMES (COs):

CO1	Analyze the wave propagation in TE, TM or TEM modes, in rectangular and circular waveguides.
CO2	To understand scattering parameters and microwave passive components and devices.
CO3	To understand the limitations of conventional tubes and to understand the generation and amplification of microwave signals.
CO4	To understand the Principle and Working of Semiconductor devices.

UNIT I- Introduction to Microwaves: Frequency Allocations, Need, Advantages and Applications of microwave signals, Overview of a typical Microwave system, Modes of propagation in guided media.

UNIT II- Waveguides and Cavity Resonators: Transverse Electric and Transverse Magnetic Waves, Wave propagation through rectangular and circular waveguides and their analysis, Power transmission and attenuation in waveguides, Electromagnetic Resonators, Rectangular & Circular Cavity Resonators, Q factor of cavity Resonators.

UNIT III- Microwave Passive Components and Devices: Scattering Matrix of Waveguide Junctions, Properties of S-Matrix, E-Plane Tee, H-plane Tee, Magic Tee, Attenuators, Directional Couplers, Ferrite Devices, Faraday Rotation, Gyrator, Isolator, Circulators and Cavity Resonators.

UNIT IV -Microwave Solid-State Devices: Gunn Diode and its Modes of Operation, Avalanche IMPATT Diode, TRAPATT Diode, Operations and V-I Characteristics of Tunnel Diode, Schottky Diode, Varactor Diodes, PIN Diode and its Applications.

UNIT V-Microwave Linear Beam and Cross Field Tubes: Klystrons, bunching and velocity modulation process, multi cavity klystron amplifier, reflex klystron, helix travelling wave tube (TWT), microwave crossed field tubes, magnetron oscillator, linear magnetron, FWCFA

TEXT BOOKS:

1. Liao S. Y., Microwave Devices and Circuits, Prentice Hall

REFERENCE BOOKS:

1. Pozar D. M., Microwave Engineering, John Wiley and Sons

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 403C	**Power Electronics**	**3-0-0-0**

COURSE OBJECTIVE:-to understand fundamental concepts on conversion and control of electric energy using power semiconductor devices in AC to DC, DC to DC, DC to AC and AC to AC converters.

COURSE OUTCOMES (COs):

CO1	Acquire knowledge about fundamental concepts and techniques used in power electronics.
CO2	Ability to analyze various single phase and three phase power converter circuits and understand their applications.
CO3	Construct and demonstrate the operation of DC-DC switching regulators, and differentiate the switching techniques and basics topologies of DC-DC switching regulators.
CO4	Foster ability to identify basic requirements for power electronics based design application.

UNIT I- Introduction: Introduction to power electronics and power semiconductor devices, characteristics and specifications of switches, ideal characteristics, characteristics of practical devices, switch specifications, figures of merit, power semiconductor devices, basic theory of operation (power diodes, BJTs, power MOSFETs, IGBTs, GTOs); SCR: Characteristics, two transistor model, protection, firing, recent advances in power semiconductor devices

UNIT II- AC-DC Converters: AC-DC uncontrolled converters: single phase halfwave rectifiers, concept of freewheeling, single phase full wave rectifiers, three phase bridge rectifiers, effect of source impedance. AC-DC controlled converters: single phase controlled converters (semi converters, full converters), analysis for different types of loads.

UNIT III- DC-DC Converters: Introduction, control of DC-DC converters, Buck, Boost and Buck-Boost Chopper configurations, continuous and discontinuous conduction mode, output voltage ripple

UNIT IV- Inverters: Introduction, principle of operation and classification (VSI and CSI), performance parameters, single phase inverters, three phase inverters, PWM control, performance of square wave inverters,
singlepulsewidthmodulation,multiplepulsewidthmodulation,sinusoidalpulsewidthmodulation,currentsourceinverters

UNIT V- AC Voltage Controllers: Introduction, principle of AC voltage control (ON OFF control, phase control), single phase controllers (Analysis for different types of loads), evaluation of performance parameters cyclo converter(1–phase)

TEXT BOOKS:

1. Muhammad H. Rashid " Power Electronics:Circuits, Devices and Applications", Pearson Education,2017.
2. P. S. Bhimbra "Power Electronics" Khanna Publishers,2022

REFERENCE BOOKS:

1. Cyril W. Lander "Power Electronics" McGraw Hill Education,1993

E-RESOURCE:

https://nptel.ac.in/courses/108102145

https://nptel.ac.in/courses/108105066

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 411C	**Microwave Engineering Lab**	**0-0-0-2**

List of Experiments:

1. To Study Microwave test bench
2. Study of Gunn oscillator as a source of microwave power and to study its operation
3. To Study V-I characteristics of Gun diode
4. Study Klystron oscillator as a source of microwave power and to study its operation
5. Study of Directional Coupler and to verify its power at different ports
6. Study as lotted wave guide section and its applications in the measurement of VSWR
7. Study a PIN diode modulator in conjunction with Gunn oscillator and to study modulation depth
8. To study the properties of E and H-plane wave guide tee junctions and to determine isolations, coupling coefficients and input VSWR

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 413C	**Power Electronics Lab**	**0-0-0-2**

List of Experiments:

1. To obtain IV characteristics of SCR, TRIAC and DIAC
2. To obtain UJT characteristics
3. To study half-wave gate controlled rectifier using one SCR
4. To study single phase half controlled full wave rectifier
5. To study three phase half controlled full wave rectifier
6. To study buck converter
7. To study boost converter
8. To study buck-boost converter
9. Study the performance of relay control combination of P,I and D control schemes in a temperature control system

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 450C	**Optical Fiber Communication**	**3-0-0-0**

COURSE OBJECTIVE: To introduce students to fundamental concepts including signal transmission through optical fibers, factors affecting fiber performance, various components and devices, and the process of system design.

COURSE OUTCOMES (COs):

CO1	Understand optical fiber, its structure, advantages and basic principle of OFC.
CO2	Transmission characteristics of fibers under different physical and operating parameters.
CO3	Understand the basic structure and operation of optical sources and detectors.
CO4	Knowledge of various fiber fabrication techniques and optical fiber connectors.

UNIT I- Introduction: Block diagram of optical fiber communication system, Advantages of optical fiber communication, Optical fiber waveguides: structure, light propagation using ray theory, introduction to wave theory; modes in planar and cylindrical guide, single mode fibers, cut-off wavelength, mode field diameter, effective refractive index, group and mode delay factor for single mode fiber.

UNIT II- Transmission: Transmission characteristics of optical fiber, attenuation in optical fibers, intrinsic and extrinsic absorption, linear and nonlinear scattering losses, fiber bend losses, dispersion and pulse broadening, intramodal and intermodal dispersion for step and graded index fibers, modal noise, dispersion shifted fibers, modal birefringence and polarization maintaining fibers.

UNIT III- Optical Sources: Einstein relations and population inversion, feedback and threshold conditions, direct and indirect bandgap semiconductors, spontaneous and stimulated emission in p-n junction, heterojunctions, injection laser structure and its characteristics, LED: Introduction, power and efficiency, structures and characteristics.

UNIT IV- Optical Detectors: Introduction, device types, detection principles; absorption, quantum efficiency, photodiodes and phototransistors, noise in p-n, p-i-n and APD receivers, concept of direct and coherent detection in optical receivers.

UNIT V-Fabrication & Deployment: Preparation of optical fibers, Liquid-phase techniques, Vapour-phase deposition techniques, Fiber strength and durability, Fiber splices, Fiber connectors, Fiber couplers.

TEXT BOOKS:

1. Optical Fiber Communication Systems by J. M Senior
2. Optical Fiber Communication by G. E. Keiser

REFERENCE BOOKS:

1. Optical Communication Systems by John Gowar.
2. Optoelectronics by Wilson and Hawkes

E-RESOURSES:

https://archive.nptel.ac.in/courses/108/104/108104113/
https://archive.nptel.ac.in/courses/108/106/108106167/
https://www.nptelvideos.com/course.php?id=522

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 402C	**Engineering Entrepreneurship**	**3-0-0-0**

COURSE OBJECTIVES: To provide them with the tools to optimize profits, minimize costs, analyze various scenarios, forecast fluctuations in business cycles, and more.

COURSE OBJECTIVES (COs):

CO1	Describe the principles of economics that govern the operation of any organization under diverse market conditions
CO2	Comprehend macroeconomic principles and decision making in diverse business set up
CO3	Explain the Inflation & Price Change as well as Present Worth Analysis
CO4	Apply the principles of economics through various case studies

UNIT I: Economic Decisions Making – Overview, Problems, Role, Decision making process. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power- Sizing Model, Improvement & Learning Curve, Benefits. Case Study - Price and Income Elasticity of Demand in the real world

UNIT II: Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.

UNIT III: Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

UNIT IV: Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. Case Study – Competition in the Advertise Segment in India

UNIT V: Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.

TEXT BOOKS:

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e Tata McGraw-Hill

REFERENCE BOOKS:

1. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP

2. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley.
3. Sullivan and Wicks: Engineering Economy, Pearson
4. R. Paneer Seelvan: Engineering Economics, PHI
5. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

E RESOURSE: www.finmin.nic.in , www.rbi.org.in , www.planningcommission.nic.in

For batches admitted in 2023 and onwards

Course Code:	**Course Title:**	**L-T-P-S**
ECE 460C	**Optical Fiber Communication Lab**	**2-0-0-2**

List of Experiments:

1. To set up an optical communication link on the SM fiber using the trainer kit and measuring visualizers.
2. To set up an optical voice communication link on the SM fiber using the trainer kit and measuring visualizers.
3. To generate a Pulse amplitude modulation signal and transmit it over an optical communication link using SM fiber and verify the results on visualizer
4. To measure propagation loss for optical SM fiber on an optical communication link tool kit.
5. To measure bending losses for optical SM fiber on an optical communication link tool kit.
6. To measure the Numerical aperture of an optical signal using single mode fiber.
7. To mend a single mode fiber using fusion type splicing technique & study the characteristics of the spliced fiber.