SREEPATHY INSTITUTE OF MANAGEMENT AND TECHNOLOGY

COURSE HANDBOOK

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER III

2019 scheme

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

To transform students into motivated, competent and socially committed engineering professionals in the core domains of Electronics & Communication through quality education and research orientation with emphasis on holistic approach.

MISSION

- To nurture young individuals into knowledgeable, skillful and ethical professionals in their pursuit of Electronics & Communication Engineering.
- To empower budding engineers with the state of art technology, team work and leadership qualities to stride forth as resourceful citizens.
- To develop industry interaction for innovation and product development to solve real time problems.

B-TECH PROGRAMME

PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

After successful completion of the program, the graduates will be

PEO1: Able to exhibit their innovative ideas and management skills to analyze, design, develop and implement electronic systems or equipment

PEO2: Able to apply knowledge in mathematics, science and computing to the field of Electronics & Communication Engineering either in industry, academics or research career with creativity and commitment

PEO3: Receptive to new technologies and attain professional competence through lifelong learning.

PEO4: Able to embody a commitment to professional ethics, diversity and social awareness in their professional career.

PROGRAM OUTCOMES (PO):

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.

3. Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOS):

Electronics and Communication Engineering graduates will be able to:

PSO1 – have the capacity to apply the concepts of Electronics, Communications, Signal processing, VLSI, Control systems, Cryptography etc., in the analysis, design**,** development and implementation of integrated electronic systems as well as to interpret and synthesize the experimental data leading to valid conclusions

PSO2 – have competence in using latest hardware and software tools, along with analytical and managerial skills for the design and analysis of complex electronic systems in furtherance to research activities.

PSO3 – be an acquaintance of social and environmental awareness with ethical responsibilities to have a successful career in real-world applications by keeping in trend with technological changes.

MAT 201 Partial Differential Equations and Complex Analysis

COURSE INFORMATION SHEET:

Program: **Electronics And Communication engineering**	Degree :**B-Tech**
Course**: Partial Differential Equations and Complex Analysis**	Course code**: MAT 201**
L-T-P**:3-0-1**	Credit**:4**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS

I	Partial differential equations, Formation of partial differential equations –elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equations, Equations solvable by direct integration, Linear equations of the first order Lagrange's linear equation, Non-linear equations of the first order - Charpit's method, Solution of equation by method of separation of variables.	8	20
II	One dimensional wave equation- vibrations of a stretched string, derivation, solution of the wave equation using method of separation of variables, D'Alembert's solution of the wave equation, One dimensional heat equation, derivation, solution of the heat equation.	10	20
III	Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, Conformal mappings- mappings $w = z^2$, $w = e^{z}$. Linear fractional transformation w =1/z, fixed points, Transformation $w = sinz$.	9	20
IV	Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method-indefinite integration and substitution of limit, second evaluation method-use of a representation of a path, Contour integrals, Cauchy integral theorem (without proof) on simply connected domain, Cauchy integral theorem (without proof) on multiply connected domain Cauchy Integral formula (without proof), Cauchy Integral formula for derivatives of an analytic function, Taylor's series and Maclaurin series.	9	20
V	Laurent's series(without proof), zeros of analytic functions, singularities, poles, removable singularities, essential singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral using residue theorem, Residue integration of real integrals integrals of rational functions of $cos\theta$ and $sin\theta$ integrals of improper integrals of the form MATHEMATICS$\int f(x)dx$ with no poles on the real axis. ($\int f(x)\,dx$ whose integrand become infinite at a point in the interval of integration is excluded from the syllabus)	9	20

TEXT BOOKS:

1	Erwin Kreyszig: Advanced Engineering Mathematics, 10th ed. Wiley

2	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.

REFERENCES:

1	Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012

PREREQUISITE: A basic course in partial differentiation and complex numbers

COURSE OBJECTIVES:

1	To understand the basic theory of functions of a complex variable, residue integration and conformal transformation.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Understand the concept and the solution of partial differential equation.
2	Analyze and solve one dimensional wave equation and heat equation
3	Understand complex functions, its continuity differentiability with the use of Cauchy-Riemann equations
4	Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula; understand the series expansion of analytic function
5	Understand the series expansion of complex function about a singularity and Apply residue theorem to compute several kinds of real integrals.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	2	1						2
CO 2	3	3	3	3	2	1						2
CO 3	3	3	3	3	2	1						2
CO 4	3	3	3	3	2	1						2

CO 5	3	3	3	3	2	1						2

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	**Using of P.D.E to solve various equations**
	PO2	**3**	**Using of PDE to solve problems**
	PO3	**3**	**The solutions for various engineering problems requires mathematical modeling**
	PO4	**3**	**Use of PDE can help to solve complex problems**
	PO5	**2**	**Using of P.D.E for modeling**
	PO6	**1**	**DE can model various daily life problems**
	PO12	**2**	**DE is a mathematical field which needs lot of research**
CO2	**PO1**	**3**	**Using PDE for solving boundary-value problems related to the diffusion of heat, waves etc.**
	PO2	**3**	**Use of wave and heat equations to solve problems**
	PO3	**3**	**PDE is used to mathematically formulate and thus aid the solution of physical and other problems involving functions of several variables such as propagation of heat or sound**
	PO4	**3**	**PDE can design various experiments**
	PO5	**2**	**In the field of acoustic, electromagnetic and fluid dynamics wave equations are used.**
	PO6	**1**	**For society we can use the P.D.E to solve problems**
	PO12	**2**	**DE is a mathematical field which needs lot of research**
CO3	**PO1**	**3**	**Fundamental knowledge in complex analysis will help to analyse engineering problems easily**
	PO2	**3**	**Basic knowledge in conformal mapping will help to model various problems in engineering fields**
	PO3	**3**	**Complex analysis helps in design and development of solution to complex**

			problems
	PO4	**3**	**Utilize the knowledge of mathematics to identify analytic functions and harmonic functions**
	PO5	**2**	**Design system components by Identifying conformal mappings and find regions that are mapped under certain transformation for engineering problems.**
	PO6	**1**	**Complex analysis may address various society related problems**
	PO12	**2**	**Complex analysis is a long field with great research opportunities**
CO4	**PO1**	**3**	**Complex integration will help to simplify problems with high complexity in Engineering**
	PO2	**3**	**The integral techniques are useful for many problems arising solid and fluid mechanics.**
	PO3	**3**	**Identify, formulate and analyze complex engineering and real life problems and provide eco-friendly and economical solutions by identifying different types of functions.**
	PO4	**3**	**Complex integration will help to design solutions to various complex engineering problems**
	PO5	**2**	**Complex integration helps in solving problems of various branches of engineering**
	PO6	**1**	**Complex analysis may address various society related problems**
	PO12	**2**	**Complex analysis is a long field with great research opportunities**
CO5	**PO1**	**3**	**Singularities and Series expansions will help to enrich the analysis of Engineering problems**
	PO2	**3**	**Utilize the knowledge of mathematics to evaluate real definite integrals as applications of residue theorem**
	PO3	**3**	**Singularities and Series expansions will help to design solutions to various complex engineering problems**
	PO4	**3**	**Use of residue theorem and series expansions to evaluate various complex problems**

	PO5	**2**	**Digital filters are designed by looking the locations of zeros and poles in the complex plane**
	PO6	**1**	**Complex analysis may address various society related problems**
	PO12	**2**	**Complex analysis is a long field with great research opportunities**

ECT 201 SOLID STATE DEVICES

COURSE INFORMATION SHEET:

Program: **Electronics And Communication engineering**	Degree : **B-Tech**
Course **: SOLID STATE DEVICES**	Course code**: ECT 203**
L-T-P**:3-1-0**	Credit**:3**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Elemental and compound semiconductors, Intrinsic and Extrinsic semiconductors, concept of effective mass, Fermions-Fermi Dirac distribution, Fermi level, Doping & Energy band diagram, Equilibrium and steady state conditions, Density of states & Effective density of states, Equilibrium concentration of electrons and holes. Excess carriers in semiconductors: Generation and recombination mechanisms of excess carriers, quasi Fermi levels.	10	20
II	Carrier transport in semiconductors, drift, conductivity and mobility, variation of mobility with temperature and doping, Hall Effect. Diffusion, Einstein relations, Poisson equations, Continuity equations, Current flow equations, Diffusion length, Gradient of quasi Fermi level	8	20
III	PN junctions: Contact potential, Electrical Field, Potential and Charge distribution at the junction, Biasing and Energy band diagrams, Ideal diode equation. Metal Semiconductor contacts, Electron affinity and work function, Ohmic and Rectifying Contacts, current voltage characteristics.Bipolar junction transistor, current components, Transistor action, Base width modulation.	11	20
IV	Ideal MOS capacitor, band diagrams at equilibrium, accumulation, depletion and inversion, threshold voltage, body effect, MOSFET-structure, types, Drain current equation (derive) linear and saturation region, Drain characteristics, transfer characteristics.	8	20

V	MOSFET scaling – need for scaling, constant voltage scaling and constant field scaling. Sub threshold conduction in MOS. Short channel effects- Channel length modulation, Drain Induced Barrier Lowering, Velocity Saturation, Threshold Voltage Variations and Hot Carrier Effects. Non-Planar MOSFETs: Fin FET –Structure, operation and advantages.	7	20

TEXT BOOKS:

1	Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010
2	Sung Mo Kang, CMOS Digital Integrated Circuits: Analysis and Design, McGraw-Hill, Third Ed., 2002 (Modules IV and V)

REFERENCES:

1	Sze S.M., Semiconductor Devices: Physics and Technology, John Wiley, 3/e, 2005
2	Sze S.M., Physics of Semiconductor Devices, John Wiley, 3/e, 2005
3	Neamen, Semiconductor Physics and Devices, McGraw Hill, 4/e, 2012
4	Pierret, Semiconductor Devices Fundamentals, Pearson, 2006
5	Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill,2015
6	Yannis Tsividis, Operation and Modelling of the MOS Transistor, Oxford University Press.
7	Jan M.Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits - A Design Perspective, PHI.

PREREQUISITES:

EST130 Basics of Electrical and Electronics Engineering

COURSE LEARNING OBJECTIVES:

This course will help students to achieve the following objectives:

1	To provide an insight into the basic semiconductor concept
2	To provide a sound understanding of current semiconductor devices and technology to appreciate its applications to electronics circuits and systems

COURSE OUTCOMES:

At the end of the course students should be able to:

CO's	DESCRIPTION
1	Apply Fermi-Dirac Distribution function and Compute carrier concentration at equilibrium and the parameters associated with generation, recombination and transport mechanism
2	Explain drift and diffusion currents in extrinsic semiconductors and Compute current density due to these effects.
3	Define the current components and derive the current equation in a pn junction diode and bipolar junction transistor.
4	Explain the basic MOS physics and derive the expressions for drain current in linear and saturation regions.
5	Discuss scaling of MOSFETs and short channel effects.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	3												3	2	
CO2	3	3												3	2	
CO3	3	3												3	2	
CO4	3	3												3	2	
CO5	3													3	2	

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	Apply the knowledge of semiconductor physics related to carrier concentrations at equilibrium, energy band diagrams and excess carrier concentrations in semiconductors.
	PO2	**3**	Analyze the relevance of carrier concentrations at equilibrium, energy band diagrams and excess carrier concentrations in semiconductors.
CO2	**PO1**	**3**	Apply the knowledge to Derive the expression for the current density in a semiconductor in response to the applied electric field.
	PO2	**3**	Analyze the expression for diffusion current in semiconductors.
CO3	**PO1**	**3**	Apply the knowledge to Derive ideal diode equation.

	PO2	**3**	Analyze the process of minority carrier distribution and terminal currents in a BJT.
CO4	**PO1**	**3**	Apply the significance of working of a MOS capacitor in the three different regions of operation.
	PO2	**3**	Analyze the working of MOSFET and derive the expression for drain current.
CO5	**PO1**	**3**	Apply the knowledge of different MOSFET scaling techniques. and short channel effects associated with reduction in size of MOSFET.

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO1**	**3**	Graduates will be able to provide novel approaches to semiconductor physics including carrier concentrations at equilibrium, energy band diagrams and excess carrier concentrations in semiconductors
	PS02	**2**	Graduates will able to apply the learnt knowledge to identify various recombination mechanisms
CO2	**PSO1**	**3**	Graduates will apply the learnt knowledge about current density in extrinsic semiconductors in specified electric field and due to concentration gradient.
	PS02	**2**	Graduates will be aware about the various contributions that can be made to real world using the concept of diffusion length in semiconductors
CO3	**PSO1**	**3**	Graduates will Identify various types of Metal Semiconductor contacts,
	PS02	**2**	Graduates will able to apply the learnt knowledge to solve numerical problems related to BJT.
CO4	**PSO1**	**3**	Graduates will be able to provide novel approaches to solve numerical problems related to currents and parameters associated with MOSFETs.
	PSO2	**2**	Graduates will able to apply the learnt knowledge about the working of a MOS capacitor in the three different regions of operation to real world applications
CO5	**PSO1**	**3**	Graduates will be able to provide novel approaches to different MOSFET scaling techniques and short channel effects associated with reduction in size of MOSFET.

	PS02	**2**	Graduates will able to apply the learnt knowledge about short channel effects associated with reduction in size of MOSFET to real world applications

ECT 203 LOGIC CIRCUIT DESIGN

COURSE INFORMATION SHEET:

Program: **Electronics And Communication engineering**	Degree : **B-Tech**
Course **: Logic Circuit Design**	Course code**: ECT 203**
L-T-P**:4-1-0**	Credit**:3**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Number systems and codes - Binary and hexadecimal number systems; Methods of base conversions; Binary and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Excess 3 code. Alphanumeric codes: ASCII. Basics of verilog -- basic language elements: identifiers, data objects, scalar data types, operators.	12	20
II	Boolean postulates and laws – Logic Functions and Gates De-Morgan's Theorems, Principle of Duality, Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS), Canonical forms, Karnaugh map Minimization. Modeling in verilog, Implementation of gates with simple verilog codes.	7	20
III	Combinatorial Logic Systems - Comparators, Multiplexers, Demultiplexers, Encoder,Decoder. Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder.Modeling and simulation of combinatorial circuits with verilog codes at the gate level.	8	20
IV	Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Conversion of Flipflops, Excitation	11	20

	table and characteristic equation. Implementation with verilog codes. Ripple and Synchronous counters and implementation in verilog, Shift registers-SIPO, SISO, PISO, PIPO. Shift Registers with parallel Load/Shift, Ring counter and Johnsons counter. Asynchronous and Synchronous counter design, Mod N counter. Modeling and simulation of flipflops and counters in verilog.		
V	TTL, ECL, CMOS - Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product. TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation; Structure and operations of TTL and CMOS gates; NAND in TTL and CMOS, NAND and NOR in CMOS.	7	20

TEXT BOOKS:

1	Mano M.M., Ciletti M.D., "Digital Design", Pearson India, 4th Edition. 2006
2	D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
3	S. Brown, Z. Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw Hill
4	Samir Palnikar"Verilog HDL: A Guide to Digital Design and Syntheis", Sunsoft Press
5	R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009

REFERENCES:

1	W.H. Gothmann, "Digital Electronics – An introduction to theory and practice", PHI, 2nd edition ,2006
2	Wakerly J.F., "Digital Design: Principles and Practices," Pearson India, 4th 2008
3	A. Ananthakumar ,"Fundamentals of Digital Circuits", Prentice Hall, 2nd edition,
4	Fletcher, William I., An Engineering Approach to Digital Design, 1st Edition, Prentice Hall India, 1980

PREREQUISITES:

EST130 Basics of Electrical and Electronics Engineering

COURSE LEARNING OBJECTIVES:

This course will help students to achieve the following objectives:

1	To work with a positional number system and numeric representations
2	To introduce basic postulates of Boolean algebra and show the correlation between Boolean expression
3	To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
4	To study the fundamentals of HDL
5	To design and implement combinational circuits using basic programmable blocks
6	To design and implement synchronous sequential circuits

COURSE OUTCOMES:

At the end of the course students should be able to:

CO's	DESCRIPTION
1	Explain the elements of digital system abstractions such as digital representations ofinformation, digital logic and Boolean algebra.
2	Create an implementation of a combinational logic function described by a truth table using and/or/inv gates/ muxes.
3	Compare different types of logic families with respect to performance and efficiency.
4	Design a sequential logic circuit using the basic building blocks like flip-flops.
5	Design and analyze combinational and sequential logic circuits through gate level.

CO-PO-PSO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2		PSO 1	PSO 2	PSO 3
CO 1	3	3												2	2	
CO 2	3	3	3											2		

CO 3	**3**	**3**												**2**	**2**	
CO 4	**3**	**3**	**3**											**2**	**2**	
CO 5	**3**	**3**	**3**		**3**									**2**	**1**	

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	Knowledge in digital system abstraction helps to find solutions for complex engineering problems
	PO2	**3**	Knowledge in digital representation of information helps to analyze complex engineering problems
CO2	**PO1**	**3**	Concepts of combinational circuits aids in finding solutions for complex engineering problems
	PO2	**3**	Implementation of a combinational logic function helps to analyze complex engineering problems
	PO3	**3**	Concepts of logic gates help to design solutions for complex Engineering problems
CO3	**PO1**	**3**	Knowledge in Logic families helps to design complex engineering problems.
	PO2	**3**	Comparison and performance of logic families helps digital electronics engineers to analyze complex engineering problems
CO4	**PO1**	**3**	Knowledge in sequential circuits helps to find solutions for complex engineering problems in digital electronics
	PO2	**3**	Knowledge in sequentialcircuits helps digital electronics engineers to analyze complex engineering problems
	PO3	**3**	Knowledge in sequentialcircuitshelps digital electronics engineers to develop solutions for complex Engineering problems
CO5	**PO1**	**3**	Knowledge in programming design helps to find solutions for complex engineering problems in digital electronics
	PO2	**3**	Knowledge in Verilog helps digital electronics engineers to develop solutions for complex Engineering problems
	PO3	**3**	Knowledge in gate level Verilog model helps Electronics engineers to analyze complex engineering problems in Electronic systems, communication, automobile , embedded systems etc areas
	PO5	**3**	Basic principles of Verilog help to develop solutions for complex Engineering problems in Electronic systems, communication, automobile, embedded systems etc areas

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO1**	**2**	Fundamentals of digital system abstractionhelps electronics engineers to design and developelectronic systems
	PSO2	**2**	Fundamentals of digital representation serves the digital electronics industry and research
CO2	**PSO1**	**2**	Concepts of combinational circuitshelps electronics engineers to design and develop efficient electronic systems
CO3	**PSO1**	**2**	Knowledge in Logic families helps electronics engineers to design and develop electronic systems
	PSO2	**2**	Comparison and performance of logic families serves the digital electronics industry and research
CO4	**PSO1**	**2**	Fundamentals of sequential circuits helps electronics engineers to design and develop electronic systems
	PSO2	**2**	Concepts of sequential circuits serves the digital electronics industry and research
CO5	**PSO1**	**2**	Fundamentals of Verilog helps electronics engineers to simulate electronic systems
	PSO2	**1**	Concepts of gate level designs serves the Embedded system industry

ECT 205 NETWORK THEORY

COURSE INFORMATION SHEET:

Program: **Electronics And Communication engineering**	Degree : **B-Tech**
Course **: NETWORK THEORY**	Course code**: ECT 205**
L-T-P**:3-1-0**	Credit**:4**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Introduction to circuit variables and circuit elements, Review of Kirchhoff's Laws, Independent and dependent Sources, Source transformations. Network topology, Network graphs, Trees, Incidence matrix, Tie-set matrix and Cut-set matrix Solution methods applied to dc and phasor circuits: Mesh and node analysis of network containing independent and dependent sources	8	20
II	Network theorems applied to dc and phasor circuits: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem. Laplace transform, properties Laplace Transforms and inverse Laplace transform of common functions, Important theorems: Time shifting theorem, Frequency shifting theorem, Time differentiation theorem, Time integration theorem, s domain differentiation theorem, s domain integration theorem, Initial value theorem, Final value theorem	10	20
III	Partial Fraction expansions for inverse Laplace transforms, Solution of differential equations using Laplace transforms Transformation of basic signals and circuits into s-domain Transient analysis of RL, RC, and RLC networks with impulse, step, pulse, exponential and sinusoidal inputs Analysis of networks with transformed impedance and dependent sources.	11	20
IV	Network functions for the single port and two ports, properties of driving point and transfer functions, Poles and Zeros of network functions, Significance of Poles and Zeros. Time domain response from pole zero plot, Impulse Response Network functions in the sinusoidal steady state,	7	20

	Magnitude and Phase response		
V	Parameters of two port network: impedance, admittance, transmission and hybrid parameters, Interrelationship among parameter sets. Series and parallel connections of two port networks Reciprocal and Symmetrical two port network Characteristic impedance, Image impedance and propagation constant (derivation not required).	11	20

TEXT BOOKS:

1	Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill,2015.
2	ValkenburgV., Network Analysis, 3/e, PHI,2011.

REFERENCES:

1	Sudhakar A,S. P. Shyammohan, Circuits and Networks- Analysis and Synthesis, 5/e, McGraw-Hill, 2015.
2	Choudhary R., Networks and Systems, 2/e, New Age International,2013.
3	Franklin F. Kuo, Network Analysis and Synthesis, 2/e, Wiley India,2012.
4	Pandey S. K., Fundamentals of Network Analysis and Synthesis, 1/e, S. Chand, 2012.
5	Edminister, Electric Circuits – Schaum's Outline Series, McGraw-Hill,2009.

PREREQUISITES:

MAT102 Vector Calculus, Differential Equations and Transforms (Laplace Transform)

COURSE LEARNING OBJECTIVES:

This course will help students to achieve the following objectives:

1	To make the students capable of analyzing any linear time invariant electrical network.
2	To study time domain, phasor and Laplace transform methods of linear circuit analysis.
3	To study the transient response of networks subject to test signals.
4	To develop understanding of the concept of resonance, coupled circuits and two port networks

COURSE OUTCOMES:

At the end of the course students should be able to:

CO's	DESCRIPTION
1	**Apply Mesh / Node analysis or Network Theorems to obtain steady state response of the linear time invariant networks.**
2	**Apply Laplace Transforms to determine the transient behaviour of RLC networks.**
3	**Apply Network functions and Network Parameters to analyse the single port and two port networks.**

CO-PO-PSO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12		PSO 1	PSO 2	PSO 3
CO1	**3**	**3**										**2**		**3**		
CO2	**3**	**3**										**2**		**1**		
CO3	**3**	**3**										**2**		**1**		

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	PO1	3	Knowledge in linear time invariant electrical network helps to find solutions for complex engineering problems.
	PO2	3	Analyze complex network problems using Mesh / Node analysis or Network Theorems included problem solving.
	PO12	2	With the basic laws and theorems, analysis of various types electrical and electronic circuits is fundamental tool for development of solutions.
CO2	PO1	3	Apply the mathematical knowledge for performing the transient analysis of RL, RC, and RLC circuits.
	PO2	3	Analysis of RL, RC, and RLC circuits using Laplace transform.
	PO12	2	The fundamentals of Laplace Transforms help in analysis of various types of electrical and electronic circuits.
CO3	PO1	3	Apply the knowledge of pole, zero concepts for finding the solution of time domain responses and of basic circuital law to analyse two port networks.
	PO2	3	Perform analysis of electrical and electronic circuits using pole, zero concept.
	PO12	2	The knowledge of Network functions and Network Parameters helps in the analysis of electronic circuits.

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION

CO1	**PSO1**	**3**	**Understand and apply the basics into analysis of circuits and complex systems.**
CO2	**PSO1**	**1**	**Apply Laplace Transform as transformation tool for design and development of complex integrated systems.**
CO3	**PSO1**	**1**	**Concepts of poles and zeros are used to analyse the behavior of systems.**

HUT 200 PROFESSIONAL ETHICS

COURSE INFORMATION SHEET:

Program: **Electronics And Communication engineering**	Degree : **B-Tech**
Course **: Professional Ethics**	Course code**: HUT 200**
L-T-P**:2-0-0**	Credit**:2**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Human Values. Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment Empathy-Self Confidence -Social Expectations.	5	20
II	Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.	5	20

III	Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.	5	20
IV	Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.	5	20
V	**Global Ethical Issues.** Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors- Moral leadership.	5	20

TEXT BOOKS:

1	M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2	R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

REFERENCES:

1	Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2	Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3	Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4	http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics**.**

PREREQUISITES:

Nil

COURSE LEARNING OBJECTIVES:

This course will help students to achieve the following objective:

1	
2	
3	
4	
5	
6	

COURSE OUTCOMES:

At the end of the course students should be able to:

CO's	DESCRIPTION
1	**Understand the core values that shape the ethical behaviour of a professional.**
2	**Adopt a good character and follow an ethical life.**
3	**Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.**
4	**Solve moral and ethical problems through exploration and assessment by established experiments.**
5	**Apply the knowledge of human values and social values to contemporary ethical values and global issues**

CO-PO-PSO MAPPING:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2		PSO 1	PSO 2	PSO 3
CO1								**2**			**2**					

CO2								**2**			**2**					
CO3								**3**			**2**					
CO4								**3**			**2**					
CO5								**3**			**2**					

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO08**	**2**	Student learns, uses, applies various ethical values, responsibility and norms of the engineering practice to meet social expectations.
	PO11	**2**	Student develop the ability to use various values in daily life, work place and there by develop their personality, professionalism, spirituality and learns to apply the same in multi - disciplinary environments.
CO2	**PO08**	**2**	Student learns, applies, ethical theories, moral dilemmas, moral autonomy understands theories of right action and uses ethical theories.
	PO11	**2**	Student develop ability to use ethical theories, principals of moral theories, uses different roles of professional action techniques, skills and management principles to do work as a member and leader in a team, to manage projects in multi-disciplinary environments
CO3	**PO08**	**3**	Student develops ethics of engineering experimentation practices uses codes of ethics develops balanced outlook on law, u responsibility and norms of the engineering practice.
	PO11	**2**	Student develops ability to use ability to use engineering as a tool of experimentation understand the need of codes of ethics and various case study techniques.
CO4	**PO08**	**3**	Student understand and apply collegiality and loyalty, learns to manage conflict, learns the roles of confidentiality, discriminate various IPRs, find out solution to reduce occupational crimes, understands professional rights, responsibility and norms of the engineering practice.
	PO11	**2**	Students develop an ability to use the values of collegiality and loyalty, confidentiality, understand the need to protect professional rights,

			employee rights, develop ability to IPR discrimination.
CO5	**PO08**	**3**	Students apply environmental ethics, computer ethics, develops roles in technical development, understand the role of engineer as managers, consultants, expert witness, advisors and work as a moral leader.
	PO11	**2**	Students develop an ability to use environmental ethics principles, computer ethics and develop engineering skills to understand their roles as managers, consultants, expert witness, advisors and moral leaders.

MCN201 SUSTAINABLE ENGINEERING

COURSE INFORMATION SHEET:

Program: **Electronics And Communication engineering**	Degree :**B-Tech**
Course**: Sustainable Engineering**	Course code**: MCN 201**
L-T-P**:2-0-0**	Credit**:0**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM)	5	20
II	Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.	6	20
III	Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.	6	20
IV	Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.	4	20

V	Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.	4	20

REFERENCES:

1	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2	Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5	ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6	Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7	Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS)
8	Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

PREREQUISITE: Nil

COURSE OBJECTIVES:

1	To inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability
2	The student should realize the potential of technology in bringing in sustainable practices.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	**Understand the relevance and the concept of sustainability and the global**

	initiatives in this direction.
2	**Explain the different types of environmental pollution problems and their sustainable solutions.**
3	**Discuss the environmental regulations and standards**
4	**Outline the concepts related to conventional and non-conventional energy**
5	**Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles**

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						**2**	**3**					**2**
CO2						**2**	**3**					**2**
CO3						**2**	**3**					**2**
CO4						**2**	**3**					**2**
CO5						**2**	**3**					**2**

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO6**	**2**	**Fundamental awareness about the concept and importance of sustainability is essential for the existence in future world**
	PO7	**3**	**The basic knowledge in sustainability helps to identify and analyze the impact caused to the environment by human activities**
	PO12	**2**	**Awareness about concept and importance of sustainability and the impact caused to the environment by human activities develops a strong desire in students for lifelong learning in the broadest context of technological change.**
CO2	**PO6**	**2**	**The study of zero waste and 3R waste concepts helps to assess societal, health, safety, legal and cultural issues**
	PO7	**3**	**Learning the basic concepts about types, causes and effects of pollution in sustainability helps to identify and analyze the environmental issues and derive solutions for the same**
	PO12	**2**	**Study of environmental pollution problems and its effect on environment develops keenness in students for lifelong learning in the broadest context of technological change.**

CO3	**PO6**	**2**	**Fundamental knowledge about Environmental Impact Assessment creates an awareness about various engineering applications in environmental management**
	PO7	**3**	**LCA and EIA study helps the students to understand impact of the engineering solutions in minimizing the environmental pollution to a greater extent**
	PO12	**2**	**Study of importance of ISO standards in environment management develops a thirst in students for lifelong learning in the broadest context of technological change.**
CO4	**PO6**	**2**	**Idea about conventional and nonconventional energy sources helps to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.**
	PO7	**3**	**Basic knowledge of various types of conventional and nonconventional energy sources helps to understand the impact of the professional engineering solutions in societal and environmental contexts.**
	PO12	**2**	**Understanding importance of nonconventional energy sources develops a desire in students for lifelong learning in the broadest context of technological change.**
CO5	**PO6**	**2**	**Basic sustainability principles help in understanding the importance of role that sustainability plays in the future existence of society**
	PO7	**3**	**Study of sustainable buildings, cities and transportion helps to Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.**
	PO12	**2**	**Study of importance of sustainable habitat develops a desire in students for lifelong learning in the broadest context of technological change.**

ECL 201 SCIENTIFIC COMPUTING LABORATORY

COURSE INFORMATION SHEET:

Program:**Electronics And Communication engineering**	Degree : **B-Tech**
Course **: Scientific Computing Laboratory**	Course code**: ECL 201**
L-T-P**:0-0-3**	Credit**:2**

SYLLABUS:

List of Experiments: (First Two and any 6 - Mandatory Experiments)

1. Familarization of the Computing Tool
2. Familarization of Scientific Computing
3. Realization of Arrays and Matrices
4. Numerical Differentiation and Integration
5. Solution of Ordinary Differential Equation
6. Simple Data Visualization
7. Simple Data Analysis with Spreadsheets
8. Convergence of Fourier Series
9. Coin Toss and the Level Crossing Problem

PREREQUISITES:

1.MAT 101 Linear Algebra and Calculus
2.MAT 102 Vector Calculus, Differential Equations and Transforms.

COURSE LEARNING OBJECTIVES:

This course will help students to achieve the following objectives:

1	To translate the mathematical concepts into system design.

COURSE OUTCOMES:

At the end of the course students should be able to:

CO's	DESCRIPTION
1	Describe the needs and requirements of scientific computing and to familiarize one programming language for scientific computing and data visualization.
2	Approximate an array/matrix with matrix decomposition.
3	Implement numerical integration and differentiation.
4	Solve ordinary differential equations for engineering applications
5	Compute with exported data from instruments
6	Realize how periodic functions are constituted by sinusoids
7	Simulate random processes and understand their statistics.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**2**	**3**											
CO2	**3**	**3**	**1**	**2**												
CO3	**3**	**3**		**1**												
CO4	**3**	**3**		**1**	**3**											
CO5	**3**	**3**		**3**					**3**	**3**						
CO6	**3**	**3**	**2**	**2**	**3**				**3**	**1**						
C07	**3**	**3**	**2**	**2**	**3**				**3**	**1**						

CO-PSO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	PO1	3	Fundamental knowledge in complex analysis will help to analyze the Engineering problems verify easily
	PO2	3	Decomposition method is used for problem analysis
	PO3	3	Integration and differentiation used to find design solutions
	PO4	2	Learn current techniques, skills and modern engineering tools necessary for computing practice.
	PO5	3	IT tool is used to model the data
CO2	PO1	3	Fundamental knowledge in complex analysis will help to analyze the Engineering problems verify easily
	PO2	3	Decomposition method is used for problem analysis
	PO3	1	Approximation is used to find solution for complex engineering problems
	PO4	2	Learn current techniques, skills and modern engineering tools necessary for computing practice.
CO3	PO1	3	Complex integration will help to simplify problems with high complexity in Engineering
	PO2	3	Complex integration will help to analyze the problem
	PO4	1	Learn current techniques, skills and modern engineering tools necessary for computing practice.
CO4	PO1	3	differentiation will help to simplify problems with high complexity in Engineering
	PO2	3	ODE is used for analyze the engineering problems
	PO4	1	Learn current techniques, skills and modern engineering tools necessary for computing practice.
	PO5	3	Scientific tool can help to model the engineering problem
CO5	PO1	3	Real time data acquisition will help to simplify problems with high complexity in Engineering
	PO2	3	Real time data modeling using IT tool
	PO4	3	Learn current techniques, skills and modern engineering tools necessary for computing practice.
	PO9	3	The data can be extracted and analyzed as a team
	PO10	3	It tool modelling helps to generate effective reports

CO 6	PO1	3	Realization of periodic functions will help to simplify problems with high complexity in Engineering
	PO2	3	Periodicity can be checked for real time problems
	PO3	2	Knowledge of periodic data used to model the solution effectively
	PO4	2	Learn current techniques, skills and modern engineering tools necessary for computing practice.
	PO5	3	Scientific tool can help to model the engineering problem
	PO9	3	The data can be extracted and analyzed as a team
	PO10	1	It tool modelling helps to generate effective reports
CO7	PO1	3	Random process will help to simplify problems with high complexity in Engineering
	PO2	3	Random process will help to analyze problems with high complexity in Engineering
	PO3	2	Knowledge of random process helps to design solution for complex engineering problems
	PO4	2	Learn current techniques, skills and modern engineering tools necessary for computing practice.
	PO5	3	Scientific tool can help to model the engineering problem
	PO9	3	The data can be extracted and analyzed as a team
	PO10	1	It tool modelling helps to generate effective reports

ECL 203 LOGIC DESIGN LAB

COURSE INFORMATION SHEET:

Program:**Electronics And Communication engineering**	Degree : **B-Tech**
Course **: LOGIC DESIGN LAB**	Course code**: ECL 203**
L-T-P**:0-0-3**	Credit**:2**

SYLLABUS:

List of Experiments - Part A [5 experiments mandatory]

1. Realization of functions using basic and universal gates (SOP and POS forms).
2. Design and Realization of half /full adder and subtractor using basic gates and universal gates.
3. 4 bit adder/subtractor and BCD adder using 7483.
4. Study of Flip Flops: S-R, D, T, JK and Master Slave JK FF using NAND gates.
5. Asynchronous Counter:3 bit up/down counter ELECTRONICS AND COMMUNICATION ENGINEERING
6. Asynchronous Counter:Realization of Mod N counter
7. Synchronous Counter: Realization of 4-bit up/down counter.
8. Synchronous Counter: Realization of Mod-N counters.
9. Ring counter and Johnson Counter. (using FF & 7495).
10. Realization of counters using IC's (7490, 7492, 7493).
11. Multiplexers and De-multiplexers using gates and ICs. (74150, 74154)
12. Realization of combinational circuits using MUX & DEMUX.
13. Random Sequence generator using LFSR.

List of Experiments- Part B [5 experiments mandatory]

Experiment 1. Realization of Logic Gates and Familiarization of FPGAs (a) Familiarization of a small FPGA bboard and its ports and interface. (b) Create the .pcf files for your FPGA board. (c) Familiarization of the basic syntax of verilog (d) Development of verilog modules for basic gates, synthesis and implementation in the above FPGA to verify the truth tables. (e) Verify the universality and non associativity of NAND and NOR gates by uploading the corresponding verilog files to the FPGA boards.

Experiement 2: Adders in Verilog (a) Development of verilog modules for half adder in 3 modeling styles (dataflow/structural/ behavioural). (b) Development of verilog modules for full adder in structural modeling using half adder.

Experiement 3: Mux and Demux in Verilog (a) Development of verilog modules for a 4x1 MUX. (b) Development of verilog modules for a 1x4 DEMUX.

Experiement 4: Flipflops and coutners (a) Development of verilog modules for SR, JK and D flipflops. (b) Development of verilog modules for a binary decade/Johnson/Ring counters

Experiment 5. Multiplexer and Logic Implementation in FPGA (a) Make a gate level design of an 8 : 1 multiplexer, write to FPGA and test its functionality. (b) Use the above module to realize the logic function f (A, B, C) = ∑m(0, 1, 3, 7) and test it. (c) Use the same 8 : 1 multiplexer to realize the logic function f (A, B, C, D) = ∑m(0, 1, 3, 7, 10, 12) by partitioning the truth table properly and test it.

Experiment 6. Flip-Flops and their Conversion in FPGA (a) Make gate level designs of J-K, J-K master-slave, T and D flip-flops, implement and test them on the FPGA board. (b) Implement and test the conversions such as T to D, D to T, J-K to T and J-K to D

Experiment 7: Asynchronous and Synchronous Counters in FPGA ELECTRONICS AND COMMUNICATION ENGINEERING(a) Make a design of a 4-bit up down ripple counter using T-flip-lops in the previous experiment, implement and test them on the FPGA board. (b) Make a design of a 4-bit up down synchronous counter using T-flip-lops in the previous experiment, implement and test them on the FPGAboard.

Experiment 8: Universal Shift Register in FPGA (a) Make a design of a 4-bit universal shift register using D-flip-flops in the previous experiment, implement and test them on the FPGA board. (b) Implement ring and Johnson counters with it.

Experiment 9. BCD to Seven Segment Decoder in FPGA (a) Make a gate level design of a seven segment decoder, write to FPGA and test its functionality. (b) Test it with switches and seven segment display. Use ouput ports for connection to the display.

PREREQUISITES:

NIL

COURSE LEARNING OBJECTIVES:

This course aims to

1. Familiarize students with the Digital Logic Design through the implementation of Logic Circuits using ICs of basic logic gates
2. Familiarize students with the HDL based Digital Design Flow.

COURSE OUTCOMES:

At the end of the course students should be able to:

CO's	DESCRIPTION
1	Design and demonstrate the functioning of various combinational and sequential circuits using ICs
2	Apply an industry compatible hardware description language to implement digital circuits
3	Implement digital circuits on FPGA boards and connect external hardware to the boards
4	Function effectively as an individual and in a team to accomplish the given task

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	3	3						3			3	1	1		3
CO2	3	1	1	3	3				3			3	1	1		3
CO3	3	1	1	3	3				3	1		3	1	1		3
CO4	3	3	3		3				3			3				3

CO-PSO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	PO1	3	Apply the knowledge of combinational and sequentialcircuits
	PO2	3	Identify and analyze customer requirement
	PO3	3	Design circuits that meets the customer needs
	PO9	3	Function effectively as an individual and as a member of team in the completion of experiment
	PO12	3	Engage in latest development of the IC technology
CO2	PO1	3	Apply the knowledge of HDL to design.
	PO2	1	Programming skills can be enhanced and this can be used to develop more powerful codes for solving problems

	PO3	**1**	**Simulate the design using HDL**
	PO4	**3**	**Use the research based knowledge in the HDL modelling**
	PO5	**3**	**Apply HDL in modelling complex engineering activities.**
	PO9	**3**	**Function effectively as an individual and as a member of team in the completion of design**
	PO12	**3**	**Get updated with the latest softwares in IC design**
CO3	**PO1**	**3**	**With sufficient practice, students will develop logic to develop more complex programs that can serve as solution to the complex problems**
	PO2	**1**	**Programming skills can be enhanced and this can be used todevelop more powerful codes for solving problems**
	PO3	**1**	**FPGA have wide scope inautomation and various fields of engineering.**
	PO4	**3**	**Programming helps to develop logic and coding skills can beused to develop more powerful software in future.**
	PO5	**3**	**FPGAs in modeling to complex engineering activities**
	PO9	**3**	**Function effectively as an individual and as a member of team in the completion of design**
	PO10	**1**	**Communicate effectively on complex engineering activities**
	PO12	**3**	**Get updated with the latest softwares in implementing FPGA**
CO4	**PO1**	**3**	**Apply the knowledge in digital circuit design.**
	PO2	**3**	**Analyze the problem more effectively.**
	PO3	**3**	**Design digital circuits for complex engineering problems**
	PO5	**3**	**Use IT tools in digital design**
	PO9	**3**	**Function effectively as an individual and in a team to accomplish the given task**
	PO12	**3**	**lifelong learning and get updated with the most modern tools**