Scheme & Syllabus of UG

Engineering Program

Bachelor of Technology

(B.Tech.)

Electronics & Communication Engineering

2024-25

IPS ACADEMY

INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(A UGC Autonomous Institute affiliated to RGPV)

IPS Academy, Institute of Engineering & Science, Indore

(A UGC Autonomous Institute, Affiliated to RGPV)

Scheme Based on AICTE Flexible Curriculum

Department of Electronics & Communication Engineering

Bachelor of Technology (B.Tech.) VII Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem	Mid Sem Exam.	Quiz/ Assignment	End Sem	Term work Lab Work & Sessional		L	T	P	
1.	PCC-EC15	PCC	Optical Fiber Communication	60	25	15	-	-	100	3	0	0	3
2.	PEC-EC03	PEC	Professional Elective Course-III	60	25	15	-	-	100	3	0	0	3
3.	PEC-EC04	PEC	Professional Elective Course-IV	60	25	15	-	-	100	3	0	0	3
4.	LC-EC16 (P)	LC	Optical Fiber Communication Lab	-	-	-	60	40	100	0	0	2	1
5.	LC-EC17 (P)	LC	Professional Elective Course-V	-	-	-	60	40	100	0	0	2	1
6.	PROJ-EC02	PROJ	Evaluation of Internship-Completed in Fifth/Sixth Semester	-	-	-	60	40	100	0	0	4	2
7.	PROJ-EC03	PROJ	Seminar I	-	-	-	-	50	50	0	0	2	1
8.	PROJ-EC04	PROJ	Project Phase - I	-	-	-	60	40	100	0	0	8	4
			Total	180	75	45	240	210	750	09	0	18	18

Professional Elective Courses-III	Professional Elective Courses-IV	Professional Elective Courses-V (LC-17(P))
PEC-EC03 (A) Microwave Engineering	PEC-EC04 (A) CMOS VLSI Design	PEC-EC05 (LC-17(P)) (A) Microwave Engineering Lab
PEC-EC03 (B) Digital Image Processing	PEC-EC04 (B) Fuzzy Logic and its Applications	PEC-EC05 (LC-17(P)) (B) CMOS VLSI Design Lab
PEC-EC03 (C) Quantum Computing & Communication	PEC-EC04 (C) Wireless Communication	PEC-EC05 (LC-17(P)) (C) Digital Image Processing Lab
PEC-EC03 (D) Voice and Data Network	PEC-EC04 (D) HDL & PLDs	

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

PCC-EC15	**Optical Fiber Communication**	**3L: 0T: 0P (03 hrs.)**	**Credits: 03**

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To expose the students to the fundamentals of optical fibers, fiber impairments, components and devices and system design.

MODULE I **(8 hrs.)**

Overview of Optical Fiber Communications (OFC): Motivation, optical spectral bands, key elements of optical fiber systems. Optical fibers: basic optical laws and definitions, optical fiber modes and configurations, mode theory for circular waveguides, single mode fibers, graded- index fiber structure, fiber materials, photonic crystal fibers, fiber fabrication, fiber optic cables

MODULE II **(8 hrs.)**

Optical sources: Light emitting diodes (LED): structures, materials, quantum efficiency, LED power, modulation of an LED. Laser diodes: modes, threshold conditions, laser diode rate equations, external quantum efficiency, resonant frequencies, structure and radiation patterns, single mode lasers, modulation of laser diodes. Power launching and coupling: source to fiber power launching, fiber to fiber joints, LED coupling to single mode fibers, fiber splicing, optical fiber connectors

MODULE III **(8 hrs.)**

Photo detectors: pin photo detector, avalanche photodiodes, photo detector noise, detector response time, avalanche multiplication noise. Signal degradation in optical fibers: Attenuation: MODULE-s, absorption, scattering losses, bending losses, core and cladding losses. Signal distortion in fibers: overview of distortion origins, modal delay, factors contributing to delay, group delay, material dispersion.

MODULE IV **(8 hrs.)**

Wavelength division multiplexing (WDM) concepts: operational principles of WDM, passive optical star coupler, isolators, circulators, active optical components: MEMS technology, variable optical attenuators, tunable optical filters, dynamic gain equalizers, polarization controller, chromatic dispersion compensators. Optical amplifiers: basic applications and types of optical amplifiers, Erbium Doped Fiber Amplifiers (EDFA): amplification mechanism, architecture, power conversion efficiency and gain. Amplifier noise, optical SNR, system applications. Performance Measurement and monitoring: measurement standards, basic test equipment, optical power measurements, optical fiber characterization, optical time-domain reflectometer.

MODULE V **(8 hrs.)**

Wavelength assignment strategies: random, first fit, least used, most used. Routing strategies: fixed, fixed alternate, dynamic. Routing and wavelength assignment in optical networks, Elasticity in optical network, routing and spectrum assignment, Physical constraints: wavelength continuity, contiguity constraints, spectrum assignment, maximum capacity constraint etc..

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. Illustrate and Review Fundamentals of the basics of optical fibers.
2. Learn different types sources used for transmissions in fiber.
3. Understanding the working of photo detector in optical fiber communication.
4. Learning of different types of optical receivers.
5. Understanding of optical network components.

Text /Reference Books:

1. Keiser, "Optical Fiber Communications", 3rd Edition, TMH, 2008.
2. Senior, "Optical Fiber Communication- Principles and Practices", 3rd Edition, Pearson Education, 2010.
3. Agarwal, "Fiber Optic Communication Systems", 3th Edition, Wiley India, 2007.
4. Palais, "Fiber Optics Communications",5th Edition, Pearson Education, 2005.
5. SatishKumar, "Fundamentals of optical Communications", 2th Edition, PHI Learning, 2014.

PEC-EC 03 (A)	Microwave Engineering	3L: 0T: 0P (03 hrs.)	Credits: 03

Prerequisite: Electromagnetic fields, Antenna and wave propagation.

Course Objective: Objective of the subject is to have understanding of Microwave Circuits & Devices.

MODULE I **(7 hrs.)**
Introduction to Microwave, History of Microwave, Microwave Band Designation, Application, Advantages of Microwave and Review of Electromagnetic. Transmission Lines: Two Wire Parallel Transmission Lines, Voltage Current Relationship, Characteristic Impedance, Reflection Coefficient, Input Impedance, Standing Waves.

MODULE II **(8 hrs.)**
Microwave Transmission Lines: Multi conductor Transmission Lines like Coaxial Lines, Breakdown Power of a Coaxial Cable, Strip Lines, Micro Strip Line and Its types. Microwave Components using Strip Line: Design Consideration of a Micro Strip Line, Microwave waveguide, Rectangular waveguide and its analysis, Circular Waveguide, modes of propagation, dominant modes, cut off wavelength, mode excitation

MODULE III **(8 hrs.)**
Microwave Generators and Amplifiers: Limitations of conventional tubes at Microwave Frequency Reflex Klystron, two and Multi Cavity Klystron Amplifiers, Oscillators and their analysis, Basics of Magnetrons, Traveling Wave Tube and their applications.

MODULE IV **(8 hrs.)**
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, Backward Diode, Varactor Diode, PIN Diode and its applications.

MODULE V **(9 hrs.)**

Microwave Components: Scattering (S) Parameters, Analysis and design of Dielectric resonators; Design of RF and Microwave low noise, Power Amplifiers, Oscillators using S- parameter techniques, Microwave T Junctions, Directional Couplers, Scattering matrix, S- parameters & its applications in Network analysis. Microwave Measurements: Measurements of Standing Wave ratio, Wavelength, Frequency, Power and radiation pattern of Antenna, CST/ ADS/ AFHSS software.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcome:
1. Understanding of Microwave Signals and Transmission Line.
2. Understanding of various types of Microwave Transmission Line and its Design Consideration.
3. Understanding of various types of Microwave Generators and Amplifiers.
4. Understanding of various types of Microwave Solid State Devices.
5. Design and analyze of High Frequency Circuits and Systems.

Text/Reference Books:
1. Robert E. Collins, “Foundations for Microwave Engineering”, International student 2nd edition, McGraw Hill Publication, 1992.
2. David M. Pozar, “Microwave Engg”, 2nd Edition, Jhon Wily Publication, 1998.
3. M Kulkarni “Microwave Engg”, 3rd edition, Umesh Publication, 2003
4. Samuel Y Liao “Microwave Devices and Circuits”, 3rd edition“, Pearson, 2003

PEC-EC03 (B)	**Digital Image Processing**	**3L: 0T: 0P (03 hrs.)**	**Credits: 03**

Course Objective: The purpose of this subject is to introduce the principles of digital image processing and to develop students' knowledge from basic signal processing techniques to advanced image processing and analysis systems.

MODULE I **(8 hrs.)**

Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

MODULE II **(8 hrs.)**

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering, FFT, applications of Image processing, wavelet transform.

MODULE III **(8 hrs.)**

Restoration: Noise models, Restoration in the Presence of Noise only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

MODULE IV **(8 hrs.)**

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing. **Wavelets:** Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, the Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

MODULE V **(8 hrs.)**

Segmentation: Point, Line, and Edge Detection, thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds, image compression, DCT, JPEG Image compression standards.

Representation and Description: Representation, Boundary descriptors.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Understand the need for image transforms different types of image transforms and their properties.
2. understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
3. Learn different feature extraction techniques for image analysis and recognition.
4. Learn different parameter of morphological Image Processing.
5. Understand different feature of segmentation.

Text/Reference Books:

1. Rafeal C.Gonzalez, Richard E.Woods ,"Digital Image Processing", 2nd Edition, Pearson Education/PHI.2004.
2. Alasdair McAndrew ,"A Computational Introduction to Digital Image Processing", CRC Press.2015.
3. 3.Adrian Low ,"Computer Vision and Image Processing", 2nd Edition, B.S.Publications.1991
4. RafealC.Gonzalez, Richard E.Woods, Steven L. Eddins," Digital Image Processing using Matlab" 2nd Edition ,Pearson Education.200

PCC-EC03 (C)	Quantum Computing & Communication	3L: 0T: 0P (03hrs.)	Credits: 03

Recommended Prerequisite: -Engineering Mathematics, Fundamental of quantum mechanics

Course Objective: To make the students understand the fundamental concepts and theories about Quantum Computing & Communication. Apply this knowledge for research in true fault-tolerant quantum computing. However, until that noise is reduced, quantum computing is still a significant factor in the next stage of cyber security and AI.

MODULE I **(6 hrs.)**
Introduction and overview: Global perspectives, Quantum bits, Quantum computation: Single qubit gates, Multiple qubit gates, Measurements in bases other than the computational basis, Quantum circuits, Quantum algorithms: Classical computations on a quantum computer, Quantum parallelism, Deutsch's algorithm, The Deutsch–Jozsa algorithm

MODULE II **(10 hrs.)**
Introduction to quantum mechanics: Linear algebra: Linear operators and matrices, The Pauli matrices, Inner products, Eigenvectors and eigenvalues, Adjoints and Hermitian operators, Tensor products, Operator functions, The commutator and anti-commutator, The polar and singular value decompositions, The postulates of quantum mechanics, State space Evolution, Quantum measurement, Distinguishing quantum states, Projective measurements, POVM measurements, Phase, Composite systems, Quantum mechanics: a global view, Application: superdense coding, The density operator.

MODULE III **(8 hrs.)**
Quantum circuits: Quantum algorithms, Single qubit operations, Controlled operations, Measurement, Universal quantum gates, Two-level unitary gates are universal, Single qubit and CNOT gates are universal, A discrete set of universal operations, approximating arbitrary unitary gates is generically hard, Quantum computational complexity

MODULE IV **(10 hrs.)**
The quantum Fourier transform and its applications: The quantum Fourier transform, Phase estimation: Performance and requirements, Applications: order-finding and factoring.

Quantum search algorithms: The quantum search algorithm, the oracle, the procedure, Geometric visualization, Performance

MODULE V **(6 hrs.)**
Quantum noise and quantum operations: Classical noise and Markov processes, Quantum operations: Overview, Environments and quantum operations, Operator-sum representation, Axiomatic approach to quantum operations, Examples of quantum noise and quantum operations.

Assessment: Mid Term tests, Assignments, Tutorial, Quiz and End semester exams.

Course Outcomes:
Students earned credits will develop ability to

1. Analyze the behavior of basic quantum algorithms.
2. Understand the concept of quantum mechanics
3. Illustrate quantum circuit model.
4. Understand quantum Fourier transform and its application.
5. Analyze quantum noise and quantum operations.

Reference / Text Books:

1. Michael A. Nielsen & Isaac L. Chuang, "Quantum Computation and Quantum Information",First Edition, Cambridge University Press,2000
2. Sandor Imre& Ferenc Balazs, "Quantum Computing and Communications: An Engineering Approach",First Edition ,Wiley,2005
3. P. Kaye, R. Laflamme, and M. Mosca "An Introduction to Quantum Computing" First Edition, OxfordUniversity Press,2006.

PEC-EC04 (A)	CMOS VLSI Design	3L: 0T: 0P (03 hrs.)	Credits: 03

Course Objective: The course is designed to give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon and the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes.

MODULE I **(8 hrs.)**

CMOS circuits: MOS Transistors: Operating principle of MOS transistor, Channel Length Modulation, CMOS logic, CMOS inverter- DC characteristics, Switching Threshold, Noise in MOS, Dynamic behavior of CMOS inverter, computing capacitances, propagation delay, power consumption, stick diagram, IC layout design.

MODULE II **(8 hrs.)**

Practical Consideration and Technology in VLSI Design: Introduction, Size and complexity of Integrated Circuits, The Microelectronics Field, IC Fabrication Process, Crystal Growth and wafer preparation, Epitaxial growth methods, oxidation, Metallization, Physical Vapor Deposition and Sputtering. Patterning: Lithography, Photo masking steps, Diffusion, Ion Implantation

MODULE III **(9 hrs.)**

CMOS Technology: Basic CMOS Technology, A Basic n-well CMOS Process, Twin Tub Processes, CMOS Process Enhancement, Interconnects and Circuit Elements, Layout Design Rules, Latch up, Physical Origin, Latchup Triggering, Latch up Prevention, Internal Latch up Prevention Techniques.

MODULE IV **(8 hrs.)**

Device Modeling: Dc Models, Small Signal Models, MOS Models, MOSFET Models in High Frequency and small signal, Short channel devices, Sub threshold Operations, Modeling Noise Sources in MOSFET's, Diode Models, Bipolar Models, Passive component Models.

MODULE V **(7 hrs.)**

Circuit Simulation: Introduction, Circuit Simulation Using Spice, MOSFET Model, Level 1 Large signal model, Level 2 Large Signal Model, High Frequency Model, Noise Model of MOSFET, Large signal Diode Current, High Frequency BJT Model, BJT Noise Model, temperature Dependence of BJT, Designing of MOS Transistor on Simulator.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Explain the basic structure and principle of MOS and the working of various modes of MOS and IC fabrication basics.
2. Analyze the models of MOS in high frequency & small signals.
3. Formulate value of drain current with maximum accuracy using successive models.
4. Design various logic circuits using, standard circuits such as register, PLA etc. and method of designing a processors.
5. Explain IC fabrication techniques and production process constrains.

Text/References Books:

1. Geiger, Allen and Strader, “VLSI Design Techniques for Analog and Digital Circuits”, International Edition, TMH Publication, 1990.
2. Sorab Gandhi, “VLSI Fabrication Principles”, 2nd Edition, Wiley-Interscience Publication, 1994.
3. Weste and Eshraghian, “Principles of CMOS VLSI design”, 2nd Edition, Pearson Education, 1993.
4. Weste, Harris and Banerjee, “CMOS VLSI Design”, 3rd Edition, Pearson Education, 2007.
5. Pucknell and Eshraghian, “Basic VLSI Design”, 3rd Edition, PHI Learning, 1995.
6. R. Jacob Baker, “CMOS Circuit Design, Layout, and Simulation” 2nd Edition, Wiley India, 2011.
7. S. M. Sze, “VLSI Technology”, 2nd Edition, TMH Publication, 2017.

PEC-EC04 (B)	**Fuzzy Logic and its Applications**	**3L: 0T: 0P (03 hrs.)**	**Credits: 03**

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To master the various fundamental concepts of fuzzy logic and artificial neural networks. This will help you to get sufficient knowledge to analyze and design the various intelligent control systems.

MODULE I **(8 hrs.)**

Basics of Fuzzy sets: Fuzzy sets, operation on Fuzzy sets, and Extensions of Fuzzy set concepts, extension principle and its applications. Geometry of fuzzy sets, sets as points, counting with fuzzy sets.

MODULE II **(8 hrs.)**

Fuzzy Relations: Basics of fuzzy relations, operations on fuzzy relations, various types of Binary fuzzy relations, fuzzy relations equations.

MODULE III **(8 hrs.)**

Membership Functions: Features of the membership function, fuzzification, Membership Value assignments — in tuition, in science, Rank ordering, Neural Networks.

MODULE IV **(8 hrs.)**

Fuzzy — to — crisp: conversions: Defuzzification methods — Max-membership principle, Central method, weighted average method, mean-max membership, center of sums, center of Largest area, first (or last) of maxima.

MODULE V **(8 hrs.)**

Fuzzy Associative memories: Fuzzy systems as between — cube mappings, fuzzy and neural Function estimators, neural Vs Fuzzy representation of structured knowledge, FANS as Mappings, fuzzy Hebb FAMS, the bi-directional FAN theorem for correlation minimum Encoding, correlation — product exuding, superimposing FAM rules, recalled outputs and defizzifaction, FAM structure Architecture. Binary input — output FAMS, example of Invented pendulum — Fuzzy contains crane control.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. Illustrate and Review Fundamentals of the concepts of regular and fuzzy sets.
2. Learn different types of fuzzy sets used in different applications.
3. Understanding the design of membership functions and fuzzification process.
4. Learning of fuzzy to crips and defuzzification process.
5. Design of different neural and fuzzy memories

Text/ Reference Books:

1. C.T. Lin and C.S.George Lee, "Neural Fuzzy Systems", PHI, 1996.
2. Bant A KOSKO, "Neural Networks and Fuzzy Systems", PHI, 1994.
3. Altrock, C.V., "Fuzzy Logic and Neuro Fuzzy Applications explained", PHI, 199

LC-EC16 (P)	**Optical Fiber Communication Lab**	**0L: 0T: 2P (02 hrs.)**	**Credits: 01**

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To expose the students to the fundamentals of optical fibers, fiber impairments, components and devices and system design.

List of Experiments:
1. To perform and analysis measure of 650 NM Fiber Optic Analog Link
2. To study of Optical Fiber connectors and splices
3. To study source of light for optical fiber
4. To perform and analysis intensity modulation of analog transmission
5. To perform and analysis propagation and attenuation loss
6. To measure frequency modulation using 650 nm fiber optic link
7. To perform and analysis measured pulse width modulation
8. To study EDFA
9. To perform and analysis optical power using optical power meter
10. To perform and analysis bending loss
11. To perform and analysis WDM
12. To perform and analysis numerical aperture(NA)

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcomes:
Students earning credits will develop ability to:
1. Illustrate and Review Fundamentals of the basics of optical fibers.
2. Learn different types sources used for transmissions in fiber.
3. Understanding the working of photo detector in optical fiber communication.
4. Learning of different types of optical receivers.
5. Understanding of optical network components.

Text /Reference Books:
1. Keiser, "Optical Fiber Communications", 3rd Edition, TMH, 2008.
2. Senior, "Optical Fiber Communication- Principles and Practices", 3rd Edition, Pearson Education, 2010.
3. Agarwal, "Fiber Optic Communication Systems", 3th Edition, Wiley India, 2007.
4. Palais, "Fiber Optics Communications",5th Edition, Pearson Education, 2005.
5. SatishKumar, "Fundamentals of optical Communications", 2th Edition, PHI Learning, 2014.

LC-EC17(P)	(A) Microwave Engineering Lab	0L: 0T: 2P (hrs.)	Credits: 01

Prerequisite: - Electromagnetic fields, Antenna and wave propagation.

List of Experiments:

1. To study the characteristics of the Reflex klystron Tube and to determine its electronic tuning range.
2. To study the V-I characteristics of Gunn Diode.
3. To determine the Standing Wave-Ratio and Reflection Coefficient.
4. To determine the operating frequency & guide wavelength in a rectangular waveguide working on TE10 mode.
5. To Study the function of multi-hole directional coupler by measuring the following parameters.
6. To Study the Isolator and Circulators.
7. To study the working of Magic Tee.
8. To measure an unknown impedance with smith chart.
9. To Study the working of Resonant Cavity.
10. To measure the attenuation of attenuator.

Course Outcome:

1. Understanding of Microwave Signals and Transmission Line.
2. Understanding of various types of Microwave Transmission Line and its Design Consideration.
3. Understanding of various types of Microwave Generators and Amplifiers.
4. Understanding of various types of Microwave Solid State Devices.
5. Design and analyze of High Frequency Circuits and Systems.

LC-EC17(P)	**(B) CMOS VLSI Design Lab**	**0L: 0T: 2P (hrs.)**	**Credits: 01**

Course Objective: The course is designed to give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon and the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes.

List of Experiments:

1. Introduction to EDA Tool (LTSPICE/Microwind/Xillinx/FPGA Kit).
2. Simulation & analysis of CMOS inverter transient & DC characteristics.
3. Simulation & analysis of 2 input NAND/NOR gate using CMOS.
4. Simulation & analysis of 2:1 MUX using pass transistor.
5. Simulation & analysis CMOS logic for Half Adder/ Full Adder using CMOS.
6. Layout design of a 2-input CMOS Inverter using any layout design tool.
7. Layout design of a 2-input CMOS NOR gate using any layout design tool.
8. Study of the switching characteristics of CMOS Inverter and find out noise margins.
9. Simulation of MOS Inverter with different loads.
10. Simulate 1-bit full adder following behavioral and structural modeling using VHDL\Verilog.
11. Implement all the logic gates in FPGA using verilog HDL. (Xilinx/ FPGA Kit).
12. Implement using 1-bit half adder and1-bit Full adder in FPGA using verilog HDL (Xilinx/ FPGA Kit).

Course outcome:

Students earning credits will develop ability to:

1. Explain the basic structure and principle of MOS and the working of various modes of MOS and IC fabrication basics.
2. Analyze the models of MOS in high frequency & small signals.
3. Formulate value of drain current with maximum accuracy using successive models.
4. Design various logic circuits using, standard circuits such as register, PLA etc. and method of designing a processors.
5. Explain IC fabrication techniques and production process constrains.

PROJ-EC02	**Evaluation of Internship-Completed in Fifth/Sixth Semester**	**0L: 0T: 4P (04 hrs.)**	**Credits: 02**

Course Objective:
The primary objective is to facilitate the transition from academic learning to professional practice by providing a structured experience where students can apply course material to real-world tasks. This experience aims to strengthen domain-specific competency, cultivate essential professional and communication skills, and encourage critical self-reflection on career interests and development needs.

Course Outcomes:
Upon successful completion and evaluation of the internship, the student will be able to:

1. **Apply Disciplinary Knowledge:** Demonstrate the practical application of theoretical concepts, methods, and skills learned in the classroom to solve problems within a professional or organizational setting.
2. **Develop Professional Skills: Exhibit proficiency** in key workplace skills, including time management, teamwork, problem-solving, adaptability, and ethical professional conduct.
3. **Communicate Effectively**: Produce clear, professional-quality documentation (e.g., reports, proposals, presentations) and communicate effectively with supervisors, colleagues, and clients in both written and oral formats.
4. **Analyze Organisational Context:** Analyze the structure, culture, and operational challenges of the host organization and understand how their role contributes to the organisation's mission and goals.
5. **Engage in Self-Assessment and Reflection**: Critically evaluate their own performance, strengths, and weaknesses during the internship, and articulate how the experience informs future academic and career decisions (i.e., identifying areas for further learning and growth).

PROJ-EC03	Seminar-I	0L: 0T: 2P (04 hrs.)	Credits: 01

Course Objective:
The core objective is to move beyond foundational knowledge and immerse students in specialised research and scholarly discourse within the given topic. This course aims to develop sophisticated critical thinking, research synthesis, and high-level communication skills necessary for advanced academic or professional work by requiring students to actively investigate and present original arguments based on complex primary and secondary sources.

Course Outcomes:
1. Synthesize complex primary and secondary sources to construct and defend an original research thesis within the specialized topic.
2. Critically evaluate the major theoretical frameworks and methodological debates prevalent in the current scholarly literature.
3. Formulate focused, compelling, and viable research questions suitable for advanced disciplinary inquiry.
4. Deliver professional-level oral presentations that clearly communicate and substantively defend research findings.
5. Participate effectively in scholarly discourse by offering insightful critiques and engaging in constructive intellectual debate.

PROJ-EC02	Project Phase-I	0L: 0T: 8P (08hrs.)	Credits: 04

Course Objectives: The core objective of Project Phase I is to establish a solid and well-documented foundation for the subsequent phases by completing all necessary research, planning, and design tasks. This includes defining the scope, identifying critical resources and constraints, and finalising the detailed project plan (including timelines and milestones) to ensure the technical feasibility and strategic alignment of the overall project goals.

Course Outcomes:

1. To understand the mathematical and physical foundations of electronics engineering and how these are used in electronic devices and systems.

2. To critically evaluate alternate assumptions, approaches, procedures, tradeoffs, and results related to engineering problems.

3. To design a variety of electronic and computer-based components and systems for applications including signal processing, communications, computer networks, and control systems.

4. To lead a small team of student engineers performing a laboratory exercise or design project; to participate in various roles in a team and understand how they contribute to accomplishing the task at hand.

5. To use written and oral communications to document work and present project results.