CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

BACHELOR OF TECHNOLOGY (B.Tech.)

(4 Year Undergraduate Degree Programme)

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

(In Alignment with National Education Policy, 2020)

[w. e. f. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
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SRM UNIVERISTY DELHI-NCR, SONEPAT
FACULTY OF ENGINEERING AND TECHNOLOGY

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (EPEOs)

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises;
4. Increasing responsibilities of technical and managerial leadership in their work organizations;
5. Professional development through a commitment to career-long learning.

FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES (EPLOs)

1. An ability to identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences
2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
4. an ability to adapt and work with multidisciplinary teams and communicate effectively;
5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks.
6. an understanding of professional and ethical responsibility;
7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

Engineering Mathematics-III (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS301	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: Engineering Mathematics – II	

COURSE EDUCTIONAL OBJECTIVES (CEOs)

1. To familiarize the students with concepts of Fourier series.
2. To familiarize the students with partial differential equations and their solution.
3. To solve boundary value problems, Heat and Wave equations.
4. To gain good knowledge in the application of Fourier transform.
5. To demonstrate understanding Z-transform.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate Fourier series in engineering applications.
2. Elaborate different types of partial differential equations.
3. Find solutions of boundary value problems including heat and wave equations.
4. Apply and analyze Fourier transforms with different applications.
5. Evaluate the problems using z-transforms.

FUNDAMENTALS OF ELECTRONIC DEVICES	
Course Code:23EC209	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the basic principles and operation of electronic devices. Provide a thorough understanding of semiconductor materials and their role in electronic devices.
2. Familiarize students with different types of electronic devices, including diodes and transistors.
3. Examine the operating principles of different types of transistors, such as bipolar junction transistors (BJTs), field-effect transistors (FETs) and MOSFET.
4. Introduce students to the concepts of biasing, small-signal modeling, and amplifier configurations using transistors.
5. Discuss the limitations and challenges associated with electronic devices and potential ways to overcome them.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the basic principles of electronic devices and the differences between passive and active components and explain the operation and characteristics of diodes, including rectification and signal modulation.
2. Analyse and model the behaviour of diodes under different biasing conditions.
3. Describe the operating principles of different types of bipolar junction transistors (BJTs), field-effect transistors (FETs) and MOSFET and their applications in electronic circuits.

4. Design and analyse simple electronic circuits using diodes bipolar junction transistors (BJTs), field-effect transistors (FETs) and MOSFET and understand the role of electronic devices in integrated circuits and their impact on circuit performance.
5. Evaluate the limitations of electronic devices and suggest potential improvements or alternative solutions and work collaboratively in teams to complete electronic devices-related projects and assignments.

DIGITAL SYSTEMS	
Course Code: 24EC203	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the basic principles and operation of electronic devices. Provide a thorough understanding of semiconductor materials and their role in electronic devices.
2. Familiarize students with different types of electronic devices, including diodes and transistors.
3. Examine the operating principles of different types of transistors, such as bipolar junction transistors (BJTs), field-effect transistors (FETs) and MOSFET.
4. Introduce students to the concepts of biasing, small-signal modeling, and amplifier configurations using transistors.
6. Discuss the limitations and challenges associated with electronic devices and potential ways to overcome them.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

5. Understand the basic principles of electronic devices and the differences between passive and active components and explain the operation and characteristics of diodes, including rectification and signal modulation.
6. Analyse and model the behaviour of diodes under different biasing conditions.
7. Describe the operating principles of different types of bipolar junction transistors (BJTs), field-effect transistors (FETs) and MOSFET and their applications in electronic circuits.
8. Design and analyse simple electronic circuits using diodes bipolar junction transistors (BJTs), field-effect transistors (FETs) and MOSFET and understand the role of electronic devices in integrated circuits and their impact on circuit performance.
9. Evaluate the limitations of electronic devices and suggest potential improvements or alternative solutions and work collaboratively in teams to complete electronic devices-related projects and assignments.

SIGNALS AND SYSTEMS	
Course Code: 24EC205	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental concepts and principles of signals and systems, familiarize students with various types of signals, such as continuous-time and discrete-time signals, enable students to understand the properties and representations of signals in both time and frequency domains and provide a thorough understanding of linear time-invariant (LTI) systems and their analysis.
2. Introduce students to the concept of convolution and its importance in signal processing and examine the Fourier series and Fourier transform, along with their applications in signal analysis.
3. Examine the Fourier transform, along with their applications in signal analysis and introduce basic concepts of system stability and system response to different input signals
4. Explore the Laplace transform and its role in analysing linear continuous-time systems and introduce basic concepts of system stability and system response to different input signals

5. Discuss the importance of sampling and quantization in digital signal processing, introduce the Z-transform and its applications in analysing discrete-time systems and introduce basic concepts of system stability and system response to different input signals and introduce students to the basics of discrete-time and continuous-time system modelling.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the concepts of signals and systems and differentiate between continuous-time and discrete-time signals, analyse and interpret signals in both time and frequency domains using mathematical techniques.
2. Understand the concept of convolution and its significance in signal processing, analyse and interpret the response of linear time-invariant (LTI) systems to different input signals and apply Fourier series to analyse periodic and aperiodic signals.
3. Apply Fourier transform to analyse periodic and aperiodic signals and analyse and interpret the response of linear time-invariant (LTI) systems to different input signals.
4. Utilize Laplace transform and the Z-transform to analyse continuous-time linear systems and their stability.
5. Model and analyse simple discrete-time and continuous-time systems using mathematical representations and work collaboratively in teams to complete signal and systems-related projects and assignments.

ELECTROMAGNETIC FIELD THEORY	
Course Code: 24EC207	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and laws of electromagnetic field theory, familiarize students with vector calculus and coordinate systems necessary for the analysis of electromagnetic fields.
2. Provide a comprehensive understanding of static electric and magnetic fields and their properties, introduce students to the concept of electromagnetic waves and their propagation in free space and different media.
3. Enable students to analyse the behaviour of electromagnetic fields in various practical engineering scenarios, Introduce the concept of electromagnetic boundary conditions and their applications.
4. Provide an understanding of Maxwell's equations and their significance in describing electromagnetic phenomena.
5. Familiarize students with the principles of transmission lines and waveguides.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the fundamental concepts of electric and magnetic fields and their interrelation, apply vector calculus to analyse electromagnetic phenomena in different coordinate systems.
2. Calculate electric and magnetic fields for various charge and current distributions.
3. Explain the concept of capacitance, inductance, and resistance in the context of electromagnetic fields and analyse the behaviour of dielectric and magnetic materials in the presence of electromagnetic fields.
4. Apply Maxwell's equations to predict and analyse electromagnetic phenomena in different situations and describe the behaviour of electromagnetic waves in different media and calculate their propagation characteristics.
5. analyse practical engineering scenarios involving electromagnetic fields, such as transmission lines and waveguides, utilize electromagnetic field simulation software for practical analysis and design purposes and work collaboratively in teams to complete electromagnetic field theory-related projects and assignments.

ELECTRONICS DEVICES LAB	
Course Code: 23EC211	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. To study experimentally the characteristics of diodes, BJT's and FET's.
2. To verify practically, the response of various special-purpose electron devices.

COURSE LEARNING OUTCOMES (CLO)

1. To verify practically, the fundamental characteristics of Electron Devices.

DIGITAL SYSTEM LAB	
Course Code: 24EC213	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. To verify the operation of logic gates and flip-flops. To design and construct digital circuits

COURSE LEARNING OUTCOMES (CLO)

To understand, the logical behaviours of digital circuits and apply them in appropriate applications.

PROGRAMMING USING PYTHON	
Course Code: 24EC208	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. To study the basic taxonomy, terminology and components of the python programming.
2. To study about the control flow and different type of functions in python programming language.
3. To study the different data types and their usage in python programming language.
4. To study different modules and libraries associated with python programming.
5. To study the visualization and plotting functions provided by python programming language.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Demonstrate the usage of basic programs of python programming.
2. Demonstrate the usage of loops, control flow and different functions.
3. Classify the different data types and their application in different scenarios.
4. Develop advanced programs in python programming using the libraries.
5. Use various visualization tools to develop graphs for data analysis.

ELECTRONIC CIRCUITS	
Course Code: 24EC202	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and analysis techniques of analog electronic circuits, familiarize students with frequency response and the analysis of AC circuits with various models for BJT and FET family

2. Provide a comprehensive understanding of feedback mechanisms and their importance in circuit stability and performance, introduce students to the design and analysis of various amplifiers and operational amplifier circuits.
3. Introduce students to the design of analog amplifiers and oscillators.
4. Explore the concept of power amplifiers and their applications in audio and radio frequency circuits.
5. Familiarize students with the concept of multi shaping circuits and their applications and introduce the concept of generation and implementation of Signal.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the fundamental concepts of analog electronic circuits and differentiate them from digital circuits, analyse and design basic BJT and FET amplifier configurations and analyse the frequency response of analog circuits and understand their bandwidth and filtering characteristics
2. Understand the concept of feedback in electronic circuits and its impact on circuit stability and performance and design and analyse various amplifier circuits and understand their applications.
3. Analyse and design simple oscillators for specific frequency responses.
4. Understand the principles of power amplifiers and design basic audio and radio frequency amplifiers.
5. Understand the concept of multi shaping circuits and their applications and work collaboratively in teams to complete analog electronics-related projects and assignments.

LINEAR INTEGRATED CIRCUITS	
Course Code: 24EC204	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and analysis techniques of linear integrated circuits, familiarize students with the characteristics and operation of linear integrated circuits, including operational amplifiers (Op-Amps) and enable students to understand the design and analysis of basic linear circuits using Op-Amps.
2. Introduce the concept of feedback in linear integrated circuits and its impact on circuit performance, provide a comprehensive understanding of various linear integrated circuit building blocks, such as voltage regulators, comparators, and timers and familiarize students with the application of linear integrated circuits in signal conditioning, filtering, and signal generation.
3. Explore the concept of active filters and their design using Op-Amps.
4. Introduce students to the principles of analog-to-digital converters (ADCs) and digital-to-analog converters (DACs).
5. Familiarize students with the design and analysis of practical linear integrated circuit circuits.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the fundamental principles of linear integrated circuits and their applications, analyze and design basic linear circuits using operational amplifiers (Op-Amps) in different configurations and understand the concept of feedback in linear circuits and its impact on circuit stability and performance.
2. Analyze the frequency response of linear integrated circuits and understand their filtering characteristics and design and analyze practical linear integrated circuits for signal conditioning and amplification.
3. Design and analyze active filters using Op-Amps for specific frequency responses.
4. Analyze the characteristics and applications of analog-to-digital converters (ADCs) and digital-to-analog converters (DACs).
5. Work with various linear integrated circuit building blocks and demonstrate their practical applications, Identify and troubleshoot issues in linear integrated circuits and propose appropriate solutions and work collaboratively in teams to complete linear integrated circuits-related projects and assignments.

TRANSMISSION LINES AND WAVEGUIDES	
Course Code: 24EC206	Continuous Evaluation: 40 Marks

Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of transmission lines and waveguides in electrical engineering and Familiarize students with the characteristics of different types of transmission lines, such as coaxial cables and microstrip lines and Enable students to understand the analysis and modelling of transmission lines for various applications.
2. Introduce the concept of waveguides and their applications in guiding electromagnetic waves.
3. Provide a comprehensive understanding of the behaviour of waveguides for different modes of propagation.
4. Explore the principles of impedance matching and signal reflection in transmission lines and waveguides and familiarize students with the basics of signal integrity in high-speed digital transmission lines.
5. Provide hands-on experience with the design and analysis of practical transmission line and waveguide systems.

COURSE LEARNING OUTCOMES (CLO)

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

1. Understand the fundamental principles of transmission lines and waveguides and differentiate them from other guided transmission media, analyse and model different types of transmission lines, including their characteristic impedance, attenuation, and phase constant and design and analyse practical transmission line structures for specific applications, such as impedance matching and signal integrity.
2. Understand the concepts of signal reflection and standing waves in transmission lines and waveguides.
3. Analyze the behavior of waveguides for different modes of propagation, including TE and TM modes and design and analyze microwave circuits using transmission lines and waveguides, such as filters and couplers.
4. Work with simulation software and measurement tools to design and analyse practical transmission line and waveguide systems.
5. Identify and troubleshoot issues in transmission line and waveguide systems and propose appropriate solutions and work collaboratively in teams to complete transmission lines and waveguides-related projects and assignments.

ELECTRONIC CIRCUITS LAB	
Course Code: **23EC212**	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. To study experimentally the working of amplifiers, regulators and analyze their behaviour by plotting graphs.

COURSE LEARNING OUTCOMES (CLO)

1. To train the students to analyze electronic circuits and understand their functionality.

ANALOG AND DIGITAL COMMUNICATION	
Course Code: 23EC303	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Grasp the basic concepts of analog and digital communication, including the need for modulation and different modulation schemes.

2. Learn about various AM types (DSBFC, DSBSC, SSB, VSB) and their characteristics such as modulation index, spectra, power relations, and bandwidth requirements.
3. Study phase and frequency modulation, including narrow band FM, wide band FM, and their respective modulation indices, spectra, power relations, and bandwidth.
4. Explore the principles of pulse modulation, sampling theorem, and the digital representation of analog signals along with noise considerations.
5. Analyze various digital modulation systems like PCM, DPCM, Delta Modulation, and understand the concepts of baseband and passband data transmission, including error probabilities and performance comparisons.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Ability to describe the need for modulation and differentiate between amplitude, phase, and frequency modulation techniques.
2. Capability to calculate and analyse modulation index, spectra, power relations, and bandwidth for different AM systems and design basic AM transmitters and receivers.
3. Proficiency in generating and detecting FM signals using direct and indirect methods and understanding FM receiver components like the PLL method and stereo FM.
4. Skill in generating and demodulating pulse amplitude modulation (PAM), pulse width modulation (PWM), and pulse position modulation (PPM) signals, and grasping the concepts of digital transmission, aliasing, and sampling.
5. Ability to implement PCM, DPCM, and Delta Modulation systems, evaluate their noise performance, and understand the principles of baseband and passband data transmission, including matched filter reception and signal space diagrams for modulation schemes like BFSK, BPSK, and QPSK.

ANTENNA AND WAVE PROPAGATION	
Course Code: 24EC0305	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of antenna systems in communication and radar applications and familiarize students with different types of antennas and their characteristics, enable students to understand the principles of electromagnetic wave propagation and radiation and introduce students to the design and analysis of basic antennas, such as dipole antennas and monopole antennas.
2. Provide a comprehensive understanding of antenna arrays and their applications in beam-forming and direction finding.
3. Introduce the concept of antenna impedance matching and its importance in maximizing power transfer and familiarize students with the principles of antenna measurement and testing techniques.
4. Explore the application of antennas in wireless communication systems, satellite communication, and radar systems.
5. Introduce students to the concepts of antenna modelling and simulation using software tools and provide hands-on experience with designing and implementing practical antenna systems.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the fundamental principles of antenna systems and their importance in communication and radar engineering, identify different types of antennas and their characteristics, including radiation patterns and impedance and analyse the principles of electromagnetic wave propagation and understand how antennas radiate and receive electromagnetic waves.
2. Design and analyse basic antennas, such as dipole antennas, for specific applications and understand the principles of antenna arrays and their use in beam-forming and direction finding.
3. Apply impedance matching techniques to design efficient antenna systems and use measurement and testing techniques to evaluate the performance of antenna systems.
4. Model and simulate antennas using software tools to optimize their design and performance and apply antennas in wireless communication systems, satellite communication, and radar systems, considering their specific requirements.
5. Work with practical antenna design tools and simulation software to implement antenna systems for specific engineering tasks and collaborate in teams to design and implement antenna systems for practical engineering projects and applications.

MICROPROCESSOR AND INTERFACING	
Course Code: 24EC307	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and architecture of microprocessors, familiarize students with the organization and operation of microprocessors and their instruction sets and Enable students to understand the basics of microcontroller-based systems and their applications.
2. Familiarize students with the basics of interrupt handling and its role in real-time systems.
3. Introduce students to the concept of serial and parallel communication protocols and their implementation in microprocessor-based systems and introduce the concept of interfacing different peripherals and devices with microprocessors, provide a comprehensive understanding of the input-output (I/O) concepts and interfacing techniques and introduce students to memory and I/O interfacing techniques for external devices and memory components.
4. Familiarize students with the basics of interrupt handling and its role in real-time systems And Introduce students to the concept of serial and parallel communication protocols and their implementation in microprocessor-based systems.
5. Provide hands-on experience with designing and implementing microprocessor-based systems and interfacing with peripheral devices.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the fundamental principles of microprocessors, their architecture, and instruction sets, analyse and interpret microprocessor-based assembly language programs and design and implement basic microcontroller-based systems for specific applications.
2. Handle interrupts and design real-time systems using microprocessors.
3. Implement serial and parallel communication protocols in microprocessor-based systems.
4. Interface different peripherals, such as displays, keyboards, and sensors, with microprocessors, implement input-output (I/O) concepts and interfacing techniques in microprocessor-based systems, design and implement memory and I/O interfacing techniques for external devices and memory components.
5. Use simulation software and development tools to model and test microprocessor-based systems and work collaboratively in teams to design and implement microprocessor-based projects with interfacing to peripheral devices.

MICROPROCESSOR LAB	
Course Code: 24EC311	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES

1. To practice assembly language programming on 8085 & 8086.
2. To practice fundamentals of interfacing/programming various peripheral devices with Microprocessor.

COURSE LEARNING OUTCOME

The students will be able to

1. Develop assembly language programs for problem solving using software interrupts and various assembler directives.
2. Implement interfacing of various I/O devices to the microprocessor/microcontroller through assembly language programming.

COMMUNICATION LAB	
Course Code: **24EC313**	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES

1. To carry out experiments on various Digital communications modulation schemes using kits. MATLABsoftware is used to simulate the digital modulation techniques
2. It is intended to demonstrate the architecture of Digital communication link components to the students.
3. Students must understand the role of each module present in the communication links.
4. They have to study by evaluating the comparing the performance of each technique used in various modules

COURSE LEARING OUTCOMES

1. To help the students to experiment on Digital communication systems using kits and to use software's to simulate them.
2. Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
3. Ability to experimentally analyze the performance of various kinds of signaling used in Digital communication systems and their bandwidth requirement.
4. They get hands on experience on system construction and performance evaluation and ability to study issues from communication links and channels, and their equalization techniques for modulation schemes like BFSK, BPSK, and QPSK.

RF AND MICROWAVE ENGINEERING	
Course Code: 24EC302	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of radio frequency (RF) filter, familiarize students with the characteristics and behaviour of RF filter and enable students to understand the design and analysis of passive RF filter.
2. Introduce the concept of active RF components and devices, including attenuators and equalizers and provide a comprehensive understanding of RF system parameters.
3. Introduce students to the analysis and design of microwave components.
4. Analyse the principles microwave devices and their applications amplifier and oscillator and Explore the principles of its measurement.
5. Provide hands-on experience with designing and analysing practical RF and microwave circuits and systems.

COURSE LEARNING OUTCOMES (CLO)

By the end of the course, students should be able to:

1. Understand the fundamental principles of radio frequency (RF) filter and their applications in various industries, analyses the behaviour of electromagnetic waves in the RF and microwave frequency ranges and design and design and analyses different types of RF filters, including low-pass, high-pass, band-pass, and band-stop filters.
2. Analyse and design concept of active RF components and devices, including attenuators and equalizers and provide a comprehensive understanding of RF system parameters.
3. Understand the operation and design principles of microwave components and devices.
4. Understand the operation and design principles of microwave devices and their applications as amplifier, oscillator and its measurement.
5. Work with simulation software and measurement tools to design and analyses practical RF and microwave circuits and systems, collaborate in teams to design and implement RF and microwave engineering projects for specific engineering tasks and applications.

OPTICAL FIBER COMMUNICATION	
Course Code: 23EC304	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES

1. Introduce students to the fundamental principles and concepts of optical fibre communication, familiarize students with the characteristics of optical fibres and their advantages in communication systems and enable students to understand the principles of light propagation in optical fibres and dispersion effects.

2. Provide a comprehensive understanding of different transmission characteristics for optical signals and familiarize students with the principles of attenuation, dispersion, radiation etc in optical communication.
3. Introduce the concept of optical sources, detectors, and amplifiers used in optical communication systems.
4. Introduce students to the design and analysis of optical communication links, communication components and systems.
5. Provide hands-on experience with designing and implementing practical optical fibre communication systems.

COURSE LEARNING OUTCOMES

By the end of the course, students should be able to:

1. Understand the fundamental principles of optical fibre communication and its significance in modern communication technologies, analyses the characteristics and advantages of optical fibres over other communication media.
2. Analyse the principles of light propagation in optical fibres, including attenuation, dispersion, and nonlinearity effects,
3. Understand the operation and characteristics of optical sources, detectors, and amplifiers used in optical communication systems.
4. Design and analyse optical communication links and systems for specific transmission requirements and understand the principles of optical network architectures, including PONs and WDM systems.
5. Work with simulation software, measurement tools to design and analyses practical optical fibre communication systems and collaborate in teams to design and implement optical fibre communication projects for specific engineering tasks and applications.

DIGITAL VLSI DESIGN	
Course Code: 23EC306	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES:

1. Introduce students to the fundamental principles and concepts of CMOS digital VLSI design and enable students to understand the FPGA and CPLD, computer aided design technology.
2. Introduce the concept of transistor sizing and its impact on circuit performance, provide a comprehensive understanding of sequential logic circuits and design techniques and familiarize students with advanced CMOS logic families and design methodologies.
3. Introduce students to layout and physical design considerations in CMOS VLSI circuits, explore the principles of clock distribution and timing analysis in digital VLSI circuits and introduce students to power consumption and dissipation considerations in CMOS VLSI designs.
4. Familiarize students with the CMOS fabrication process and the characteristics of CMOS technology.
5. Provide hands-on experience with designing and implementing practical CMOS digital VLSI circuits.

COURSE OUTCOME

By the end of the course, students should be able to:

1. Understand the fundamental principles and concepts of CMOS digital VLSI design and their applications in modern integrated circuits.
2. Design and analyse basic CMOS digital gates and logic circuits for specific functionality, apply transistor sizing techniques to optimize the performance of CMOS logic circuits.
3. Implement physical layout considerations and constraints in CMOS VLSI designs and analyse and optimize the timing and clock distribution in digital VLSI circuits and analyse the power consumption and dissipation in CMOS VLSI circuits and propose power reduction techniques.
4. Analyse and interpret the characteristics of CMOS technology and the CMOS fabrication process.
5. Work with electronic design automation (EDA) software tools for CMOS VLSI design and simulation and collaborate in teams to design and implement CMOS digital VLSI projects for specific engineering tasks and applications.

MICROWAVE AND OPTICAL COMMUNICATION LAB	
Course Code: 23EC312	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks

L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES

1. To have a detailed practical study on microwave equipment
2. To study the optical devices and to use in the appropriate application

COURSE LEARNING OUTCOME

1. To know and understand how communication is being established at microwave
2. Frequencies and using Fiber in optical communication.

DIGITAL VLSI DESIGN LAB	
Course Code: 24EC314	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination:60 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES

To gain expertise in design and development and simulation of digital circuits with VHDL.

COURSE OUTCOME

To know and understand VHDL and design circuits using it.

1.

CIRCUIT ANALYSIS & SYNTHESIS	
Course Code: 24EPE211	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite:	

COURSE OBJECTIVES (COs)

1. Introduce students to the fundamental principles and techniques of network analysis and synthesis, familiarize students with different types of electrical networks and their applications. And introduce the concept of network theorems and their applications in simplifying complex circuits.
2. Provide a comprehensive understanding of transient state analysis of networks using Laplace transforms and Fourier analysis.
3. Introduce the concept of graph theory and the analysis networks.
4. Explore the principles of two-port network analysis and their applications in transmission lines and amplifiers.
5. Familiarize students with network synthesis techniques for designing desired network responses, introduce students to the principles of network stability and control in feedback systems and provide hands-on experience with designing and analysing practical electrical networks.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of electrical network analysis and synthesis, interpret the behaviour and characteristics and apply network theorems to simplify and analyse complex circuits.
2. analyse electrical networks in transient state using Laplace transforms and Fourier analysis.
3. Understand the principles of graph theory, apply them to design and analyse different networks.
4. Analyse and design two-port networks for specific applications in transmission lines and amplifiers.
5. Design and synthesize networks with desired frequency responses using appropriate techniques, analyse the stability and control of networks in feedback systems, use simulation software and measurement tools to model and test electrical networks and collaborate in teams to design and implement network-related projects and assignments.

DIGITAL SIGNAL PROCESSING	
Course Code: 24EPE212	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite:	

COURSE OBJECTIVES (COs)

1. Introduce students to the fundamental principles and concepts of digital signal processing, familiarize students with the properties and characteristics of discrete-time signals and systems and enable students to understand the basics of sampling theorem and its practical implementation.
2. Provide a comprehensive understanding of the discrete Fourier transform (DFT) and its relationship with the fast Fourier transform (FFT) algorithm.
3. Familiarize students with the principles of FIR and IIR filters and its applications, Introduce students to the design and analysis of digital signal processing algorithms for various applications.
4. Provide hands-on experience with designing and implementing practical digital signal processing algorithms

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of digital signal processing and its importance in various engineering fields, analyse and interpret discrete-time signals and systems using mathematical techniques.
2. Understand the principles of the discrete Fourier transform (DFT), apply the fast Fourier transform (FFT) algorithm for efficient spectral analysis and Design and implement digital signal processing algorithms, such as convolution, correlation, and spectral estimation.
3. Analyse and interpret the spectral characteristics of signals using different signal processing techniques, design and implement digital filters (FIR & IIR) for specific signal processing applications
4. Work with simulation software and programming tools to design and implement practical digital signal processing algorithms and collaborate in teams to design and implement digital signal processing projects for specific engineering tasks and applications.

DIGITAL SIGNAL PROCESSING	
Course Code: 24EPE212	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite:	

COURSE OBJECTIVES (COs)

5. Introduce students to the fundamental principles and concepts of digital signal processing, familiarize students with the properties and characteristics of discrete-time signals and systems and enable students to understand the basics of sampling theorem and its practical implementation.

6. Provide a comprehensive understanding of the discrete Fourier transform (DFT) and its relationship with the fast Fourier transform (FFT) algorithm.
7. Familiarize students with the principles of FIR and IIR filters and its applications, Introduce students to the design and analysis of digital signal processing algorithms for various applications.
8. Provide hands-on experience with designing and implementing practical digital signal processing algorithms

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

5. Understand the fundamental principles and concepts of digital signal processing and its importance in various engineering fields, analyse and interpret discrete-time signals and systems using mathematical techniques.
6. Understand the principles of the discrete Fourier transform (DFT), apply the fast Fourier transform (FFT) algorithm for efficient spectral analysis and Design and implement digital signal processing algorithms, such as convolution, correlation, and spectral estimation.
7. Analyse and interpret the spectral characteristics of signals using different signal processing techniques, design and implement digital filters (FIR & IIR) for specific signal processing applications
8. Work with simulation software and programming tools to design and implement practical digital signal processing algorithms and collaborate in teams to design and implement digital signal processing projects for specific engineering tasks and applications.

INSTRUMENTATION & CONTROL ENGINEERING	
Course Code: 24EC301	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of instrumentation and control systems and Familiarize students with various instruments used for measurement in control systems and introduce students to the fundamental principles and concepts of Instruments.
2. Familiarize students with the different types of control systems and their applications in various engineering fields, enable students to understand the mathematical modelling of dynamic systems for control analysis and introduce the concept of feedback control and its role in regulating and stabilizing systems.
3. Provide a comprehensive understanding of control system components, such as controllers, sensors, and actuators and Introduce students to various control strategies, such as proportional, integral, and derivative (PID) control.
4. Explore the principles of frequency domain and time domain analysis of control systems.
5. Familiarize students with modern control techniques, such as state-space control and digital control and introduce students to control system design and optimization techniques and provide hands-on experience with designing, implementing, and analysing control systems using simulation software and practical experiments.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles of instrumentation and control systems and their role in various engineering applications, Identify and select appropriate instrument for measuring different process variables in control systems and understand the fundamental principles of instrumentation systems and their importance in engineering applications.
2. Identify different types of control systems and their use in specific engineering fields. Formulate mathematical models of dynamic systems for control analysis and design.
3. Analyse and interpret the stability and performance of control systems using time domain and frequency domain methods, Design control systems to achieve desired performance specifications, such as transient response and steady-state error.
4. Design and implement feedback control systems using proportional, integral, and derivative (PID) control strategies and analyse the response of control systems to different inputs and disturbances.

5. Understand the concepts of state-space control and digital control and their advantages in modern control systems, apply control system design techniques for optimal performance and stability, work with simulation software to model and analyse control systems in various engineering applications and troubleshoot and identify potential issues in control systems and propose appropriate solutions.

EMBEDDED SYSTEM DESIGN USING MICROCONTROLLER	
Course Code: 23EPE312	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of embedded systems and microcontrollers, familiarize students with the architecture and components of microcontrollers. And enable students to understand the process of embedded system design, including hardware and software considerations.
2. Introduce the concept of programming microcontrollers using a high-level language and assembly language.
3. Provide a comprehensive understanding of interfacing peripherals and sensors with microcontrollers.
4. Familiarize students with real-time operating systems (RTOS) and their applications in embedded systems.
5. Introduce students to embedded system debugging and testing techniques and explore the principles of power management and optimization in embedded systems.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of embedded systems and their applications in various industries, analyse and interpret the architecture and components of microcontrollers and their role in embedded system design.
2. Design and implement embedded systems, considering both hardware and software aspects.
3. Program microcontrollers using high-level language and assembly language for specific applications and interface peripherals and sensors with microcontrollers for data acquisition and control.
4. Apply real-time operating systems (RTOS) to manage concurrent tasks in embedded systems.
5. Apply debugging and testing techniques to identify and resolve issues in embedded system designs and design and implement power management techniques to optimize energy consumption in embedded systems.

MIXED SIGNAL SYSTEM DESIGN	
Course Code: 23EPE314	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of mixed-signal system design and familiarize students with the challenges and considerations in integrating analog and digital components in a single system.
2. Enable students to understand the specifications and requirements for mixed-signal systems in various applications
3. Introduce the concept of data converters (ADCs and DACs) and their role in mixed-signal systems.
4. Provide a comprehensive understanding of mixed-signal simulation and verification techniques and Familiarize students with the principles of noise analysis and signal integrity in mixed-signal systems.
5. Introduce students to the design of mixed-signal integrated circuits (ICs) and explore the principles of low-power design and optimization in mixed-signal systems.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of mixed-signal system design and their applications in modern electronic systems and analyse and interpret the challenges and considerations in integrating analog and digital components in a mixed-signal system.
2. Design and implement mixed-signal systems to meet specific specifications and requirements.
3. Analyse the performance and characteristics of data converters (ADCs and DACs) and apply them in mixed-signal system designs and apply mixed-signal simulation and verification techniques to validate the functionality and performance of mixed-signal systems.
4. Analyse and mitigate noise issues and signal integrity problems in mixed-signal systems.
5. Design mixed-signal ICs and PCBs for specific engineering applications and apply low-power design techniques to optimize energy consumption in mixed-signal systems.

VLSI FABRICATION TECHNOLOGY	
Course Code: 23EPE314	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of VLSI (Very Large-Scale Integration) fabrication technology and familiarize students with the various process steps involved in semiconductor device fabrication.
2. Enable students to understand the materials and equipment used in VLSI fabrication.
3. Introduce the concept of cleanroom practices and safety protocols in semiconductor manufacturing.
4. Provide a comprehensive understanding of photolithography, etching, deposition, and diffusion processes used in VLSI fabrication.
5. Familiarize students with process integration and yield improvement techniques in VLSI manufacturing and introduce students to the challenges and advancements in VLSI fabrication technology.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of VLSI fabrication technology and its significance in modern semiconductor manufacturing and analyse and interpret the various process steps involved in VLSI fabrication, from device design to wafer processing.
2. Identify and explain the materials and equipment used in different VLSI fabrication processes and apply cleanroom practices and safety protocols in semiconductor manufacturing environments.
3. Analyze and describe the photolithography, etching, deposition, and diffusion processes used in VLSI fabrication.
4. Apply process integration techniques to design and manufacture complex VLSI circuits.
5. Analyze and interpret yield improvement techniques to enhance manufacturing efficiency and product quality in VLSI fabrication and understand the challenges and advancements in VLSI fabrication technology and their impact on semiconductor devices.

HDL PROGRAMMING AND SYSTEM DESIGN	
Course Code: 23EPE413	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of Hardware Description Languages (HDLs) and their role in digital system design and familiarize students with HDL programming languages such as Verilog or VHDL.
2. Enable students to understand the design flow of digital systems using HDLs.
3. Introduce the concept of synthesizable and non-synthesizable HDL constructs.
4. Provide a comprehensive understanding of modeling digital circuits and components using HDLs.
5. Familiarize students with verification and simulation techniques for HDL designs and introduce students to FPGA and ASIC implementation using HDLs.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of HDLs and their importance in digital system design and analyse and interpret HDL programming languages such as Verilog or VHDL for modelling digital circuits.
2. Design and implement digital systems using HDLs and understand the design flow.
3. Distinguish between synthesizable and non-synthesizable HDL constructs for hardware implementation.
4. Model and simulate digital circuits and components using HDLs and verify and test HDL designs using simulation techniques and testbenches.
5. Implement digital systems on FPGA or ASIC platforms using HDLs and Apply HDL-based system design to solve practical engineering problems.

ASIC AND FPGA SYSTEM DESIGN	
Course Code: 23EPE415	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of ASIC (Application-Specific Integrated Circuit) and FPGA (Field-Programmable Gate Array) system design and familiarize students with the architecture and components of ASICs and FPGAs.
2. Enable students to understand the design flow and methodologies for ASIC and FPGA development.
3. Introduce the concept of hardware description languages (HDLs) and their role in ASIC and FPGA design and provide a comprehensive understanding of the design considerations for ASIC and FPGA implementations.
4. Familiarize students with the use of design tools and synthesis techniques for ASIC and FPGA development.
5. Introduce students to the concept of verification and testing of ASIC and FPGA designs.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of ASIC and FPGA system design and their significance in modern digital systems and analyse and interpret the architecture and components of ASICs and FPGAs for specific application domains.
2. Design and implement digital systems using ASIC and FPGA platforms, considering design flow and methodologies.
3. Use hardware description languages (HDLs) to model and simulate digital circuits for ASIC and FPGA designs and analyse and apply design considerations, such as performance, power, and area trade-offs, for ASIC and FPGA implementations.
4. Work with design tools and synthesis techniques to develop ASIC and FPGA designs and apply verification and testing techniques to validate the functionality and performance of ASIC and FPGA designs.
5. Design and implement complex digital systems on ASIC and FPGA platforms to solve practical engineering problems.

VLSI TESTING

Course Code: 23EPE417	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of VLSI testing and its significance in semiconductor manufacturing and familiarize students with the various types of faults that can occur in VLSI circuits.
2. Enable students to understand the techniques and methodologies used in VLSI testing for fault detection and diagnosis.
3. Introduce the concept of test generation and fault modelling in VLSI circuits.
4. Provide a comprehensive understanding of test compression and design-for-testability (DFT) techniques and familiarize students with scan chains, boundary scan, and built-in self-test (BIST) methodologies.
5. Introduce students to the challenges and advancements in VLSI testing.

COURSE LEARNING OUTCOMES (CLOs)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of VLSI testing and its role in ensuring the quality and reliability of semiconductor devices and analyse and interpret the types of faults that can occur in VLSI circuits and their impact on device performance.
2. Apply techniques and methodologies for VLSI testing to detect and diagnose faults in digital circuits.
3. Design and generate tests to detect various types of faults in VLSI circuits and apply test compression and DFT techniques to optimize test time and resource requirements.
4. Design and implement scan chains, boundary scan, and BIST methodologies for VLSI testing.
5. Analyse and interpret test results to evaluate the quality and reliability of VLSI circuits and understand the challenges and advancements in VLSI testing, such as at-speed testing and defect-oriented testing.

LOW POWER VLSI DESIGN	
Course Code: 23EPE419	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite:	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of low-power VLSI design and familiarize students with the challenges and considerations in designing low-power VLSI circuits and systems.
2. Enable students to understand different low-power design techniques and methodologies.
3. Introduce the concept of power optimization and trade-offs in VLSI circuits and provide a comprehensive understanding of power-gating, voltage scaling, and clock gating techniques.
4. Familiarize students with circuit-level and system-level power reduction strategies.
5. Introduce students to low-power design for various VLSI applications, such as IoT, mobile devices, and wearable electronics.

COURSE LEARNING OUTCOMES (CLOs)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of low-power VLSI design and its significance in modern electronic systems and analyse and interpret the challenges and considerations in designing low-power VLSI circuits and systems.
2. Design and implement low-power VLSI circuits using various power optimization techniques and methodologies.
3. Analyse and evaluate power consumption in VLSI circuits and explore power trade-offs during design and apply power-gating, voltage scaling, and clock gating techniques to achieve power reduction in VLSI circuits.

4. Apply circuit-level and system-level power reduction strategies in VLSI design.
5. Design low-power VLSI systems for specific engineering applications, such as IoT devices and mobile electronics.

CIRCUIT ANALYSIS & SYNTHESIS	
Course Code:24EPE211	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and techniques of network analysis and synthesis, familiarize students with different types of electrical networks and their applications. And introduce the concept of network theorems and their applications in simplifying complex circuits.
2. Provide a comprehensive understanding of transient state analysis of networks using Laplace transforms and Fourier analysis.
3. Introduce the concept of graph theory and the analysis networks.
4. Explore the principles of two-port network analysis and their applications in transmission lines and amplifiers.
5. Familiarize students with network synthesis techniques for designing desired network responses, introduce students to the principles of network stability and control in feedback systems and provide hands-on experience with designing and analysing practical electrical networks.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of electrical network analysis and synthesis, interpret the behaviour and characteristics and apply network theorems to simplify and analyze complex circuits.
2. Analyze electrical networks in transient state using Laplace transforms and Fourier analysis.
3. Understand the principles of graph theory, apply them to design and analyse different networks.
4. Analyze and design two-port networks for specific applications in transmission lines and amplifiers.
5. Design and synthesize networks with desired frequency responses using appropriate techniques, analyse the stability and control of networks in feedback systems, use simulation software and measurement tools to model and test electrical networks and collaborate in teams to design and implement network-related projects and assignments.

DIGITAL SIGNAL PROCESSING	
Course Code:24EPE212	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of digital signal processing, familiarize students with the properties and characteristics of discrete-time signals and systems and enable students to understand the basics of sampling theorem and its practical implementation.
2. Provide a comprehensive understanding of the discrete Fourier transform (DFT) and its relationship with the fast Fourier transform (FFT) algorithm.
3. Familiarize students with the principles of FIR and IIR filters and its applications, Introduce students to the design and analysis of digital signal processing algorithms for various applications.
4. Provide hands-on experience with designing and implementing practical digital signal processing algorithms

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of digital signal processing and its importance in various engineering fields, analyse and interpret discrete-time signals and systems using mathematical techniques.
2. Understand the principles of the discrete Fourier transform (DFT), apply the fast Fourier transform (FFT) algorithm for efficient spectral analysis and Design and implement digital signal processing algorithms, such as convolution, correlation, and spectral estimation.
3. Analyse and interpret the spectral characteristics of signals using different signal processing techniques, design and implement digital filters (FIR & IIR) for specific signal processing applications
4. Work with simulation software and programming tools to design and implement practical digital signal processing algorithms and collaborate in teams to design and implement digital signal processing projects for specific engineering tasks and applications.

INSTRUMENTATION & CONTROL ENGINEERING	
Course Code:24EC301	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Fundamental of Electronic Devices	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of instrumentation and control systems and Familiarize students with various instruments used for measurement in control systems and introduce students to the fundamental principles and concepts of Instruments.
2. Familiarize students with the different types of control systems and their applications in various engineering fields, enable students to understand the mathematical modelling of dynamic systems for control analysis and introduce the concept of feedback control and its role in regulating and stabilizing systems.
3. Provide a comprehensive understanding of control system components, such as controllers, sensors, and actuators and Introduce students to various control strategies, such as proportional, integral, and derivative (PID) control.
4. Explore the principles of frequency domain and time domain analysis of control systems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles of instrumentation and control systems and their role in various engineering applications, Identify and select appropriate instrument for measuring different process variables in control systems and understand the fundamental principles of instrumentation systems and their importance in engineering applications.
2. Identify different types of control systems and their use in specific engineering fields. Formulate mathematical models of dynamic systems for control analysis and design.
3. Analyse and interpret the stability and performance of control systems using time domain and frequency domain methods, Design control systems to achieve desired performance specifications, such as transient response and steady-state error.
4. Design and implement feedback control systems using proportional, integral, and derivative (PID) control strategies and analyse the response of control systems to different inputs and disturbances.

NEURAL NETWORK & FUZZY LOGIC	
Course Code: 24EPE321	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of neural networks and fuzzy logic, familiarize students with the basic structure and operation of artificial neural networks and enable students to understand the principles of Perceptron Algorithm and Feed Forward and Back Propagation Networks in neural networks.
2. Introduce the concept of fuzzy logic and its application in handling uncertainty and imprecision in decision-making and provide a comprehensive understanding of fuzzy membership functions and fuzzy rules.
3. Familiarize students with the design and implementation of fuzzy logic systems.
4. Introduce students to the concept of neural-fuzzy systems and their applications in intelligent control and decision-making.
5. Explore the principles of neural network training algorithms, such as back propagation and radial basis function (RBF) networks and provide hands-on experience with designing and implementing practical neural network and fuzzy logic systems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of artificial neural networks and fuzzy logic, analyze and interpret the basic structure and operation of neural networks and apply supervised and unsupervised learning techniques in neural networks for pattern recognition and data clustering.
2. Understand the principles of fuzzy logic and apply fuzzy membership functions and fuzzy rules for handling uncertainty and imprecision and design and implement fuzzy logic systems for decision-making and control applications.
3. Analyse the principles of neural-fuzzy systems and apply them to intelligent control problems.
4. Design and implement neural networks for specific applications using appropriate training algorithms.
5. Work with simulation software and programming tools to design and implement practical neural network and fuzzy logic systems and collaborate in teams to design and implement neural network and fuzzy logic projects for specific engineering tasks and applications.

INTRODUCTION TO MACHINE LEARNING	
Course Code: 24EPE322	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of reinforcement learning (RL) and familiarize students with the components of RL, such as agents, environments, and rewards.
2. Enable students to understand different RL algorithms and their applications in solving sequential decision-making problems.
3. Introduce the concept of Markov Decision Processes (MDPs) and their use in modelling RL problems.
4. Provide a comprehensive understanding of various RL techniques, including value iteration, policy iteration, and Q-learning, familiarize students with exploration-exploitation trade-offs and their role in RL and introduce students to the concept of function approximation in RL.
5. Explore the principles of deep reinforcement learning and its applications in complex tasks and provide hands-on experience with implementing RL algorithms and solving RL problems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of reinforcement learning and its significance in artificial intelligence and machine learning and analyse and interpret the components of reinforcement learning, including agents, environments, and rewards.
2. Apply different RL algorithms to solve sequential decision-making problems, such as dynamic programming and Monte Carlo methods.

3. Model and solve RL problems using Markov Decision Processes (MDPs). Design and implement RL algorithms, such as value iteration, policy iteration, and Q-learning, for specific applications.
4. Analyze the exploration-exploitation trade-offs in RL and apply appropriate strategies for different scenarios and use function approximation techniques to handle large state and action spaces in RL.
5. Analyze and implement deep reinforcement learning algorithms using neural networks for complex tasks, work with RL libraries and simulation environments to implement and test RL algorithms and collaborate in teams to design and implement RL projects for specific problem domains.

ADVANCED WIRELESS COMMUNICATION	
Course Code: 24EPE324	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 21EC0502	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of wireless communication systems, familiarize students with the different wireless communication technologies and their applications and enable students to understand the basic concepts of radio frequency (RF) propagation and channel characteristics.
2. Provide a comprehensive understanding of multiple access techniques and their role in wireless networks and familiarize students with the principles of cellular communication systems and their design.
3. Introduce the concept of wireless modulation techniques and their use in data transmission.
4. Introduce students to the concept of wireless network protocols and architectures
5. Explore the principles of antenna design and beam-forming in wireless communication and provide hands-on experience with designing and analysing practical wireless communication systems.

COURSE LEARNING OUTCOME (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of wireless communication and its significance in modern communication systems, analyse and interpret different wireless communication technologies and their applications in various industries and analyse the radio frequency (RF) propagation and channel characteristics in wireless communication systems.
2. Analyse multiple access techniques and apply them to manage concurrent users in wireless networks.
3. Design and analyse wireless modulation techniques for efficient data transmission in wireless channels and design and analyse cellular communication systems and their coverage and capacity planning.
4. Understand the principles of wireless network protocols and architectures, such as Wi-Fi and cellular standards and
5. Design and analyse antenna systems and beamforming techniques for improved wireless communication performance, work with simulation software and measurement tools to model and test wireless communication systems and collaborate in teams to design and implement wireless communication projects for specific engineering tasks and applications.

NETWORK SECURITY	
Course Code: 23EPE421	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of network security, familiarize students with the threats and vulnerabilities in computer networks and communication systems and enable students to understand various cryptographic techniques and their applications in securing data and communication.

2. Introduce the concept of authentication, authorization, and access control mechanisms in network security and provide a comprehensive understanding of network security protocols and their role in securing network communication.
3. Familiarize students with network intrusion detection and prevention systems.
4. Introduce students to security policies and risk management in network environments.
5. Explore the principles of secure network design and implementation.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of network security and its importance in modern communication systems, identify and analyse the threats and vulnerabilities in computer networks and communication systems and apply cryptographic techniques to secure data transmission and protect sensitive information in network communication.
2. Design and implement authentication, authorization, and access control mechanisms to control network access.
3. Analyze and implement network security protocols, such as SSL/TLS and IPsec, to ensure secure communication.
4. Understand the principles of network intrusion detection and prevention systems and their role in detecting and mitigating network attacks.
5. Analyze and implement security policies and risk management strategies to protect network assets and design and implement secure network architectures and configurations to minimize security risks and threats.

DATA COMMUNICATION NETWORK	
Course Code: 24EPE23	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of data communication networks, familiarize students with the different network architectures and topologies used in data communication and enable students to understand the functions and components of data communication networks, including routers, switches, and protocols.
2. Introduce the concept of network protocols and their role in data transmission and error detection.
3. Provide a comprehensive understanding of the TCP/IP protocol suite and its applications in the Internet.
4. Familiarize students with the principles of network security and its importance in data communication.
5. Introduce students to the concept of network management and troubleshooting techniques and explore the principles of network performance analysis and optimization.

COURSE LEARNING OUTCOME (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of data communication networks and their significance in modern communication systems, Identify and analyse different network architectures and topologies for specific communication requirements.
2. Analyse the functions and components of data communication networks, including routers, switches, and other network devices and design and implement network protocols for efficient data transmission and error detection.
3. Analyse and interpret the TCP/IP protocol suite and its applications in the Internet and other communication systems.
4. Understand the principles of network security and apply appropriate measures to secure data communication and apply network management and troubleshooting techniques to ensure the smooth operation of data communication networks.
5. Analyse the performance of data communication networks and optimize their design for improved efficiency.

INTERNET OF THINGS (IOT) AND APPLICATIONS	
Course Code: 23EPE425	Continuous Evaluation: 40 Marks

Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of the Internet of Things (IoT), familiarize with the architecture and components of IoT systems and enable to understand the communication protocols and technologies used in IoT devices and networks.
2. Introduce the concept of IoT data analytics and its applications in extracting meaningful insights from IoT-generated data.
3. Provide a comprehensive understanding of IoT security and privacy challenges and their mitigation strategies.
4. Familiarize students with the design and implementation of IoT applications for various industries, such as smart homes, healthcare, and industrial automation.
5. Introduce students to the concept of IoT cloud platforms and their role in IoT applications and explore the principles of edge computing and its application in IoT systems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of the Internet of Things and its significance in modern connected systems, Identify and analyse the architecture and components of IoT systems for specific application domains.
2. Analyse the communication protocols and technologies used in IoT devices and networks.
3. Design and implement IoT data analytics techniques to extract valuable insights from IoT-generated data and apply security and privacy measures to address the challenges in IoT systems.
4. Design and develop IoT applications for various industries, considering their unique requirements.
5. Work with IoT cloud platforms to deploy and manage IoT applications and analyse the principles of edge computing and apply it in IoT systems for efficient data processing and reduced latency.

INFORMATION THEORY AND CODING	
Course Code: 23EPE427	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to the fundamental principles and concepts of information theory, familiarize with the basics of entropy, information, and source coding and Enable students to understand the principles of channel capacity and channel coding.
2. Introduce the concept of error-correcting codes and their applications in data transmission and storage.
3. Provide a comprehensive understanding of data compression techniques and their role in efficient data representation.
4. Familiarize students with the principles of rate-distortion theory and its applications in multimedia communication.
5. Introduce students to the concept of source-channel coding and joint source-channel coding.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental principles and concepts of information theory and its significance in various communication systems and analyse and interpret entropy, information, and source coding techniques for efficient data representation and calculate and analyse channel capacity and apply channel coding techniques for reliable data transmission.
2. Design and implement error-correcting codes for error detection and correction in data communication and storage.
3. Apply data compression techniques to reduce data redundancy and achieve efficient data representation.

4. Analyse and apply rate-distortion theory in multimedia communication for optimal data representation.
5. Design and implement joint source-channel coding techniques for error-resilient data transmission.

NETWORK MODELLING USING REINFORCEMENT LEARNING	
Course Code: 23EPE429	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. Introduce students to advanced concepts of network modelling and optimization, familiarize with reinforcement learning (RL) algorithms and their applications in network optimization and
2. Enable to understand the fundamentals of Q-learning, Deep Q-Networks (DQNs), and other RL techniques.
3. Familiarize students with the integration of RL in software-defined networking (SDN) and network function virtualization (NFV) architectures.
4. Introduce the concept of network simulations and modelling using RL for performance evaluation and optimization. Introduce students to the concept of multi-agent RL and its applications in distributed network optimization.
5. provide a comprehensive understanding of how RL can be applied to solve various network design and management problems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the advanced concepts of network modelling and optimization using reinforcement learning and analyse and interpret different RL algorithms, including Q-learning and DQNs, and apply them to network problems and
2. Design and implement network simulations using RL to evaluate and optimize network performance and apply RL techniques to solve specific network design and management problems, such as routing, resource allocation,
3. Analyse the integration of RL in SDN and NFV architectures to enhance network flexibility and performance.
4. Apply multi-agent RL techniques to optimize network performance in distributed and complex environments and load balancing and
5. Work with simulation tools and RL frameworks to model and simulate advanced network scenarios and collaborate in teams to design and implement RL-based network modelling projects for specific engineering tasks and applications.

DATA SCIENCE	
Course Code: 23EPE332	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. To provide an overview of an exciting field of Predictive Analytics.
2. To introduce the tools required For the Predictive Analytics.
3. To review and explore data to look at data distributions and to identify data problems, including missing values.
4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.
5. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explore the fundamental concepts of data science
2. Understand data analysis techniques for applications handling large data
3. Understand various machine learning algorithms used in data science process
4. Visualize and present the inference using various tools.
5. Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making.

AI AND EXPERT SYSTEMS	
Course Code: 23EPE334	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

1. To learn the fundamentals of AI and role of agents in AI.
2. To understand the search which is the first building block of AI and its applications.
3. To understand and analyse the second building block of AI that is knowledge representation and handling uncertainty.
4. To understand the concepts of planning and learning to create smart applications.
5. To learn the applications of AI for NLP and Expert system designing.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

6. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
7. Solve problems like constraint satisfaction search and optimization problem.
8. Deduce through logic and reasoning algorithms.
9. Understand the role of planning and learning in automated control and smart applications.
10. Formalize a given problem in the language/framework of different AI methods and Design and carry out an empirical evaluation of different algorithms on a problem formalization

DEEP LEARNING	
Course Code: 23EPE431	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (CO)

6. Introduce students to advanced concepts of network modelling and optimization, familiarize with reinforcement learning (RL) algorithms and their applications in network optimization and
7. Enable to understand the fundamentals of Q-learning, Deep Q-Networks (DQNs), and other RL techniques.
8. Familiarize students with the integration of RL in software-defined networking (SDN) and network function virtualization (NFV) architectures.
9. Introduce the concept of network simulations and modelling using RL for performance evaluation and optimization. Introduce students to the concept of multi-agent RL and its applications in distributed network optimization.
10. provide a comprehensive understanding of how RL can be applied to solve various network design and management problems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

6. Understand the advanced concepts of network modelling and optimization using reinforcement learning and analyse and interpret different RL algorithms, including Q-learning and DQNs, and apply them to network problems and
7. Design and implement network simulations using RL to evaluate and optimize network performance and apply RL techniques to solve specific network design and management problems, such as routing, resource allocation,
8. Analyse the integration of RL in SDN and NFV architectures to enhance network flexibility and performance.
9. Apply multi-agent RL techniques to optimize network performance in distributed and complex environments and load balancing and
10. Work with simulation tools and RL frameworks to model and simulate advanced network scenarios and collaborate in teams to design and implement RL-based network modelling projects for specific engineering tasks and applications.

PROBABILITY & RANDOM PROCESS	
Course Code: 24AS404	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVE (CO)

1. To familiarize the students with concepts of random variables, two dimensional random variables, distributions, random process and linear systems with random inputs that are used in many engineering problems.
2. To introduce basic Probability theory and Random variables, its types and concept of moments.
3. To equip the students with the knowledge of Discrete and continuous probability distributions with their applications.
4. To get exposed the students with the knowledge of two-dimensional Random variables and their transformations.
5. To extend the concept of random variable to random process and its basics that are applicable in engineering problems.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate knowledge of basic probability & random variables.
2. To understand techniques of developing discrete & continuous probability distributions and its applications.
3. Describe a random process in terms of its mean and correlation functions.
4. Gain knowledge in special processes like Poisson, Renewal processes.
5. Gain knowledge in spectral density, linear systems with random inputs.

DATA COMMUNICATION LAB	
Course Code: 24EPE455	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES

To study the computer communication networks characteristics and to analyse the Date Link Layer, Network Layer, Transport Layer of the network and various routing protocol and Various MAC and routing layer Protocols.

COURSE OUTCOME

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. To know and understand computer communication networks Network Simulator (NS2) tool.

MINOR PROJECT	
Course Code: 24LP413	Continuous Evaluation: 40 Marks

Credits: 4	End Semester Examination:60 Marks
L T P : 0 0 8	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To develop the ability of design and implement a project by applying Engineering knowledge:
2. To apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
3. To enhance the Problem analysis skill: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

COURSE LEARNING OUTCOME (CLO)

1. Student will be able to design and implement a major project by applying Engineering knowledge:
2. Will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
3. Will be able to solve the problem analysis skill: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

MAJOR PROJECT	
Course Code: 24LP402	Continuous Evaluation: 40 Marks
Credits: 12	End Semester Examination:60 Marks
L T P : 0 0 24	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To develop the ability of design and implement a project by applying Engineering knowledge:
2. To apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
3. To enhance the Problem analysis skill: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

COURSE LEARNING OUTCOME (CLO)

2. Student will be able to design and implement a major project by applying Engineering knowledge:
3. Will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Will be able to solve the problem analysis skill: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.