Semester-III

2EC301 Electronics Devices & Circuits [3 0 2 4]

Course Outcome:

1. At the end of the course, students will be able to
2. Apply the concept of semiconductor physics and basic electronic devices to design various circuits
3. Analyze and design electronic circuits using BJT
4. Comprehend the operation of MOSFET
5. Design, implement and test basic electronic circuits

2EC302 Signals and Systems [3 0 0 3]

Course Outcome:

After successful completion of the course, a student will be able to –

1. Classify the signals and evaluate properties of LTI systems
2. nalyze LTI systems in time domain and frequency domain
3. Demonstrate the use of state space model and its realization for LTI continuous and discrete time systems

2EC303 Digital Logic Design [4 0 0 4]

Course Outcome:

At the end of the course, the students will be able to

1. Perform binary arithmetic operations.
2. Optimize the Boolean equations using the k-map and tabulation method.
3. Design and implement combinational and sequential circuits.
4. Design digital systems using Hardware Description Language on reconfigurable devices.

2EC304 **Network Theory** **[3 0 0 3]**

Course Outcome:

At the end of the course, students will be able to -

1. Analyze the steady state and transient behaviour of components
2. Apply basic laws to analyze various circuits in time domain as well as frequency domain
3. Synthesize an electrical network from given impedance/admittance function

2EC305 **Digital Design Laboratory** **[0 0 2 1]**

Course Outcome:

At the end of the course, students will be able to -

1. Design digital circuits using MSI/LSI logic components
2. Implement digital circuits on reconfigurable hardware using HDL

Semester-IV

2EC401 **Electromagnetics and Wave Propagation** **[3 0 0 3]**

Course Outcome:

At the end of the course, students will be able to

1. Apply vector calculus to understand the behavior of static electric, magnetic, and electromagnetic fields in standard configurations.
2. Classify the properties of conductors, dielectrics, and magnetic materials.
3. Interpret Maxwell's equations of electromagnetics in integral and differential forms.
4. Apply Maxwell's equations for solving different electromagnetic problems.

2EC402 **Analog Circuits** **[3 0 2 4]**

Course Outcome:

At the end of the course, students will be able to

1. Comprehend the fundamentals of op-amp and its basic amplifier configurations
2. Analyse the linear and non-linear applications of operational amplifier
3. Design and Construct various circuits using operational amplifier based ICs

2EC403 **Communication Systems** **[3 0 2 4]**

Course Outcome:

At the end of the course, students will be able to -

1. Comprehend probability & stochastic theories as applied to signals and noise
2. Analyze analog modulation techniques and receiver fundamentals used in analog communication
3. Apply baseband digital encoding & decoding techniques in the storage / transmission of digital signal through wired channel
4. Apply techniques like matched filter, pulse shaping, line encoding and equalizer to mitigate the adverse effects of noise and dispersion

2EC404 **Microprocessors and Microcontrollers** **[3 0 2 4]**

Course Outcome:

At the end of the course, students will be able to –

1. Comprehend the architecture and instruction set of 8086 microprocessor and 8051 microcontroller
2. Demonstrate assembly language programming proficiency
3. Develop interface logic for interconnection of peripheral devices with microprocessor and microcontroller

SEMESTER V

EC501 **VLSI Design** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to

1. Analyze the digital VLSI circuits working with resistive load, NMOS, PMOS and CMOS load conditions under linear and saturation region.
2. Evaluate digital VLSI circuits for speed, area, power, cost and output voltage requirements.
3. Design combinational, sequential and dynamic logic circuits using CMOS for given specifications.
4. Simulate and optimize digital VLSI circuits and layouts using EDA Tools.

EC502 **Digital Signal Processing** **[3 0 2 4]**

Course Outcomes:

At the end of the course, the students will be able to

1. Analyse the LTI system using Z-transform to determine the effect of the pole and zero on the overall system response for one-dimensional signals.
2. Analyse the spectrum for one-dimensional signals using DFT and realize DFT using FFT algorithms.
3. Design IIR and FIR digital filters for the given specifications and analyse the finite word-length effect on a designed filter.
4. Interpret the Multirate system using the sampling rate converter in areas such as communication systems, signal compression, and sub-band signal processing

EC503 **Digital Communication** **[3 0 2 4]**

Course Outcomes:

At the end of the course, the students will be able to

1. Analyze the process of converting the baseband signal into a passband signal using various digital modulation techniques.
2. Apply the spread spectrum modulation principles in communication systems.
3. Appreciate the role of information theory and error control coding for obtaining error-free communication.
4. Comprehend the fundamental concepts of wireless communication.

2ECDEXX Department Elective – I (with lab)

2ECDE51 **Image Processing** **[3 0 2 4]**

Course Outcomes:

At the end of the course, the students will be able to

1. Apply spatial and frequency domain image filters for Image enhancement.
2. Comprehend image degradation models for image restoration and colour transforms.
3. Apply morphological operations for image morphing applications.
4. Interpret and apply edge detection, image segmentation and representation for image recognition.

2ECDE52 Fiber Optic Communication [3 0 2 4]

Course Outcome:

At the end of the course, the students will be able to

1. Interpret the propagation of light through optical fiber and analyse performance degradation due to signal distortion.
2. Analyze the performance of optical sources and detectors, transmitters and receivers.
3. Comprehend the concept of WDM and SONET/ SDH.
4. Apply techniques for measurement of attenuation, dispersion and numerical aperture.

2ECDE53 Mobile Programming [3 0 2 4]

Course Outcome:

At the end of the course, the students will be able to

1. Comprehend the characteristics and architecture of mobile applications.
2. Design and develop mobile applications using the android application development framework.
3. Design and develop multimedia applications on the android platform.
4. Choose sensors to be used for the design of a given mobile application.

2ECDE54 System on Chip Design [3 0 2 4]

Course Outcome:

At the end of the course, the students will be able to

1. Design, optimize, and program a modern System-on-a-Chip.
2. Analyse a computational task; characterize its computational requirements for SoC.
3. Identify performance bottlenecks and explore a rich design space of solution.
4. Implement hardware and software solutions, formulate hardware/software tradeoffs, and perform hardware/software co-design.

2ECDE55 **Scripting Language** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to

1. Develop programmes for automation of scripts in EDA tool design flow in the Linux environment.
2. Produce scripts using Python for scientific programming.
3. Build Perl scripts for automation in the IC design flow.

2ECDE68 **Digital System Design** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to

1. Design and optimize digital circuits and systems.
2. Classify and compare the architectures of programmable logic devices.
3. Apply the concept of finite state machines for digital system design.
4. Design digital systems using Hardware Description Language on reconfigurable devices.

SEMESTER VI

2EC601 **Computer Architecture** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to

1. Evaluate the performance of the processor for given specifications.
2. Design arithmetic logic unit for a given instruction set.
3. Analyse the performance of a single and multicycle data path.
4. Realize cache mapping and virtual memory address translation schemes.

2EC602 **Machine Learning** **[2 0 2 3]**

Course Outcome:

At the end of the course, the students will be able to

1. Apply regression techniques for machine learning examples.
2. Comprehend supervised and unsupervised machine learning techniques.
3. Apply the neural network and dimensionality reduction techniques for machine learning applications.
4. Design and implement machine learning algorithms to solve real-world application problems.

2ECDEXX-Department Elective–II (without Lab)

2ECDE01 **Speech and Audio Signal Processing** **[3 0 0 3]**

Course Outcome:

At the end of the course, the students will be able to

1. Comprehend the speech production and hearing models.
2. Design and apply models for speech and audio signal processing.
3. Apply speech coding, speech enhancement and speaker recognition algorithms for speech and audio processing.
4. Implement the methods for speech enhancement and speech coding for speech signals.

2ECDE02 **Satellite Communication** **[3 0 0 3]**

Course Outcome:

At the end of the course, the students will be able to

1. Comprehend the principle, operation and working of various subsystems of satellite as well as the earth station.
2. Analyze and design a satellite link.
3. Apply communication techniques in satellite applications.

4. Appreciate the role of satellite in a wide spectrum of applications such as navigation, remote sensing, and communication.

2ECDE03 Optical Devices and Networks [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. Comprehend the principles and operations of different WDM networking components and elements.
2. Comprehend WDM Network architectures and analyse different issues in WDM Networks.
3. Analyse RWA problem and RWA algorithms.
4. Analyse requirements and structure of optical packet switching and optical access networks.

2ECDE04 Analog CMOS Integrated Circuits [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to

1. Analyze the given analog circuit using a large signal, small signal and high-frequency models and evaluate performance parameters.
2. Design an analog signal conditioning circuit using the operational amplifier for the given specific application.
3. Apply noise analysis for analog CMOS circuits and evaluate input signal noise and output signal noise.
4. Design an amplifier using switching capacitors circuits for the given specifications

2ECDE05 Electronic System Design [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. Identify the design issues in analog and mixed-signal circuit design.

2. Analyze the performance parameters of the Analog-Digital Converter (ADC-DAC).
3. Rectify the design issues in the digital circuit layout.
4. Analyze system design issues due to Electro-Magnetic Interference (EMI) and Electro Static Discharge (ESD).

2ECDEXX -Department Elective-III (with Lab)

2ECDE56 **Multimedia Systems** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to

1. Evaluate lossy and lossless compression methods for multimedia content transmission.
2. Apply transform coding algorithms for image compression applications.
3. Analyse image, video and audio compression standards.
4. Comprehend multimedia communication network protocols, DTH technology and media synchronization methods for real word communication-related applications.

2ECDE57 **Wireless Communication** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to

1. Characterize and model wireless channels.
2. Evaluate Bit Error Rate (BER) and outage performance of MIMO wireless Communication systems with diversity techniques using mathematical analysis and simulations.
3. Analyze the performance of wireless systems using outage probability and channel capacity for MIMO systems with spatial multiplexing.
4. Comprehend GSM and CDMA based cellular standards.

2ECDE58 Information and Coding Theory [3 0 2 4]

Course Outcome:

At the end of the course, the students will be able to

1. Comprehend probability and statistics in Information Theory.
2. Evaluate the performance of source coding algorithms such as Huffman, Arithmetic and dictionary techniques.
3. Analyse BER performance with block codes and convolutional codes in AWGN.
4. Evaluate the performance of the communication system with Iterative decoding in AWGN for Turbo codes and LDPC codes.

2ECDE59 Wireless Communication [3 0 2 4]

Course Outcome:

At the end of the course, the students will be able to

1. Perform functional and timing verification.
2. Identify possible physical defects and model them as logical faults to determine their concerned test vectors.
3. Develop scan chain insertion and generate the test set.
4. Develop Design-for-Test and Built-In-Self-Test circuits as per the given applications.

2ECDE60 Embedded Systems [3 0 2 4]

Course Outcome:

At the end of the course, the students will be able to –

1. Propose the block diagram (architecture) of an embedded system for given specifications.
2. Comprehend modern controller architecture along with bus protocols.
3. Develop an application using real-time operating system and device driver.

2ECOEXX- Open Elective – II

2ECOE01 Wireless Sensor Network [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. Design a wireless sensor network for given sensor data using microcontroller, transceiver, middleware and operating system.
2. Evaluate the performance of schedule based and random Medium Access Control protocols for power consumption, fairness, channel utilization and control packet overhead.
3. Evaluate the performance of Geographic routing protocols for power consumption, scalability and latency parameters.
4. Evaluate the performance of transport control protocols for congestion detection and avoidance, reliability and control packet overhead parameters.

2ECOE02 Signal Processing and its Applications [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. Analyse the LTI system using time-domain methods like convolution and correlation.
2. Analyse the signal and systems representation in the frequency domain using Z-transform and Discrete Fourier Transform.
3. Design IIR and FIR digital filters for the given specifications and study its application for speech and biomedical signal processing.

2ECOE03 Introduction to Embedded Systems [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. Identify the design requirements of an embedded system.
2. Design embedded system hardware.
3. Comprehend the operation of Real-Time Operating System and Device Drivers.
4. Interpret standards related to the networking of embedded systems.

2ECOE04 Fundamentals of Image and Video Processing [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. Apply spatial and frequency domain image filters for image enhancement.
2. Comprehend image degradation models for image restoration and color space transforms for color image processing.
3. Interpret and apply edge detection, image segmentation and representation for image recognition.
4. Demonstrate the use of image and video processing algorithms for different applications.

2ECOE51 Microcontrollers and Applications [2 0 2 3]

Course Outcome:

At the end of the course, the students will be able to

1. Comprehend the architecture of 8051 microcontroller.
2. Demonstrate Microcontroller programming proficiency.
3. Develop interface logic for the interconnection of peripheral devices and motors with a microcontroller for a given application.

2ECOE76 **MATLAB for Engineers** **[2 0 2 3]**

Course Outcome:

At the end of the course, the students will be able to

1. Utilize a methodical approach to identify, formulate, and solve computational problems.
2. Comprehend MATLAB basics, branching and looping.
3. Apply MATLAB in solving algebra calculus problems.
4. Apply various techniques to solve and visualize engineering-related computational problems using MATLAB.

SEMESTER - VII

2EC701 **Microwave and Antenna Engineering** **[3 0 2 4]**

Course Outcome:

At the end of the course, the students will be able to –

1. comprehend the important parameters and properties of wire, aperture, reflector, and microstrip antennas and microwave devices.
2. analyse the wire, aperture, reflector, and microstrip antennas, and microstrip devices.
3. design conventional microwave antennas, dividers, couplers, and filters to meet given specifications.
4. test antennas and microwave components using the standard instruments/test benches.

2EC702 **Computer Networks** **[3 0 0 3]**

Course Outcome:

At the end of the course, the students will be able to -
1. comprehend OSI layer architecture and protocols for wired and wireless networks.
2. apply computer networking standards for network design.
3. evaluate the networking protocols.
optimize the Computer network performance using different routing and security algorithms

2ECDEXX- Department Elective-IV(without lab)

2ECDE06 Estimation and Detection Theory [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -
1. apply hypothesis testing using Bayes, Minimax, and Neyman Pearson criteria for random parameters and evaluate performance using receiver operating characteristics.
2. analyse estimation criteria using MMSE, MAP, and MLE for random parameters and unknown constants.
3. evaluate the performance of digital communication systems and spectrum sensing techniques using detection and estimation theory.
4. comprehend the performance of RADAR and Biomedical signal processing using detection and estimation techniques.

2ECDE07 RF Communication Circuits [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -

1. understand the RF fundamentals and RF transceiver architectures.
2. design RF integrated circuits used in receiver RF front end like LNA, Mixers, and VCO/PLL.
3. analyse other RF integrated circuits like amplifiers, switches, attenuators, couplers, etc.
4. apply RF layout fundamentals in implementing RF integrated circuits.

2ECDE08 Broadband Wireless Communication [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -

1. apply multi-carrier modulation in broadband wireless communication.
2. analyse MIMO system and scheduling algorithms in LTE.
3. evaluate the performance of broadband communication using LTE advanced.
4. use 5G networks for low power communication using IoT.

2ECDE09 MEMS Design [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -

1. analyze the concepts of advanced Micro/Nanofabrication technologies.
2. design different techniques and processes for microsensors.
3. identify applications of MEMS in the area of optical communication, RF modulators, switches, devices, and displays.
4. apply techniques of RF MEMS switches in the design of relays, varactors, phase shifters, and antennas.

2ECDE10 Modern Processor Architecture [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to –

1. comprehend the design steps for pipelined processors and classify pipelined processors.
2. deploy suitable superscalar technique(s) to enhance the performance of processors for given specifications.
3. recommend suitable data and memory flow techniques to overcome hazards in modern processor architectures.
4. design finite state machine diagram to overcome cache coherence issues in the multiprocessor system.

2ECDE11 Cyber Physical Systems [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to -

1. address challenges in implementing a cyber-physical system from a computational perspective.
2. integrate real-valued and dense time real-time systems with software-based discrete automated control.
3. design of cyber-physical systems using formal methods.
4. validate cyber-physical system problems for safety assurance and security aspects.

2ECDEXX-Department Elective-V(with Lab)

2ECDE62 Computer Vision [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to –

1. apply mathematical modeling methods for low, intermediate, and high-level Image processing tasks.
2. comprehend the geometric relationships between 2D Images and the 3D world.
3. utilize motion and shape analysis algorithms for computer vision applications.

4. perform experiments on computer vision problems.

2ECDE63 High Performance VLSI Design [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to –

1. evaluate the noise effects for integrated circuits.
2. modeling of devices using submicron technology.
3. design of VLSI interconnects for nanometer technology.
4. analyze and design on-chip clock generators and distribution.

2ECDE64 Wireless Sensor Network [3 0 0 3]

Course Outcome:

At the end of the course, the students will be able to

1. comprehend the principles, features, network architecture, and applications of the wireless sensor network.
2. select a suitable type of sensor, hardware platform, communication protocol, energy harvesting technique, and security protocol for a given application.
3. evaluate the performance of Sensor-MAC, Zebra-MAC Medium Access Control protocols for given wireless sensor networks for power consumption, fairness, channel utilization, and control packet overhead.
4. analyse the performance of Congestion Detection and Avoidance, Event-to-Sink Reliable Transport Control and Pump Slowly Fetch quickly protocols for a given wireless sensor network for reliability, congestion control and control packet overhead parameters.

2ECDE65 Internet of Things [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -

1. design an Internet of Things framework for a given application using a suitable sensor, microcontroller unit, communication protocol, and cloud architecture.
2. comprehend sensor types, power management, IP-based and non-IP-based WLAN, WPAN and WWAN communication protocols, and cloud messaging protocols related to IoT.
3. evaluate the performance of cloud service models for the given application.
4. analyse the performance of Zigbee, Bluetooth, and WiFi 6LoPAN for a given Internet of Things application for reliability, congestion control, and control packet overhead parameters.

2ECDE66 Embedded Operating Systems [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -

1. comprehend fundamental concepts of real-time systems.
2. recognize processes, threads, tasks, task scheduling, inter-process communication, and input-output operations related to real-time systems.
3. decide an embedded operating system for a given embedded system application.
4. evaluate the performance of µCOS and RTx51 Tiny for a given embedded system application for time and memory complexity.

2ECDE67 Single Board Computers for Electronic System Design [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to –

1. comprehend the fundamental features of Single Board Computers and their role in electronic system design.
2. realize sensor interfacing of Raspberry Pi, Arduino, and ESP8266.
3. develop input/output and networking-related programs for Single Board Computers.

4. evaluate the performance of Raspberry Pi, Arduino, and ESP8266 for a given electronic system design for input/output, networking, time, and memory complexity.

2EC703 Minor Project [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to –

1. make use of acquired knowledge for the problem identification and definition,
2. analyze the technical aspects of the project with a comprehensive and systematic approach,
3. propose and select the appropriate solution,
4. appraise the importance of an individual/team for effective execution,
5. compile and conclude the project with effective communication amongst peers, mentors, and society.

2EC704 Summer Internship [3 0 0 3]

Course Outcome:

At the end of the course, students will be able to -

1. perceive a better understanding of the engineering workplace,
2. adapt competencies necessary for a professional career,
3. value interpersonal and human relationship skills,
4. build the foundation for industrial internship / major project.

SEMESTER – VIII

2EC801 Major Project/Industrial Internship [0 0 22 11]

Course Outcome:

At the end of the course, students will be able to –

1. make use of acquired knowledge for the problem identification and definition related to industry/research/societal need,
2. analyze the technical aspects of the project with a comprehensive and systematic approach,
3. select the appropriate modern tool(s) and technique(s) for problem-solving,
4. propose and select the appropriate and cost-effective solution,
5. appraise the importance of an individual/team for effective execution,
6. value the health, environment, safety, and ethical practices during the project,
7. perceive the possibility of scalability and scope of intellectual property rights,
8. compile and conclude the project with effective communication amongst peers, mentors, and society.
9. Develop life-long learning skills for a productive career