Koneru Lakshmaiah Education Foundation
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Department of Electronics and Communication Engineering
Program: B.Tech -ECE
Academic Year : 2021-22

Course Code	Course Name	CO No.	CO DESCRIPTION
20UC1101	Integrated Professional English	CO1	Understand the concepts of grammar to improve communication, reading, and writing skills
		CO2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context . Demonstrate ability to face formal situations / interactions.
		CO3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate rhetorical devices
		CO4	Apply the concepts of writing to draft corporate letters, emails and memos
20UC1202	English Proficiency	CO1	Demonstrating different interpersonal skills for employability
		CO2	Distinguishing Business essential skills
		CO3	Classifying social media and corporate communication skills.
		CO4	Applying analytical thinking skills
20UC2103	Professional Communicatio n Skills	CO1	Able to spot the common grammatical errors related to sentence structure, preposition, concord, relative and conditional clauses and parallel structures. The learner should be efficient to construct a context- determined text in addition to learning Technical Writing Skills.
		CO2	Able to read, understand, and interpret a text intrinsically as well as extrinsically. The learner can browse a text quickly to come-up with a gist and personal interpretation. Able to create a healthy work- environment and prove to be an asset or one of the most reliable resources to the organization.
		CO3	Apply the concepts of time and work; men-time-work problems based on wages, pipes and cisterns. Apply the concepts of time and distance and solve the problems related to average speed,

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			relative speed.
		CO4	Apply Venn diagrams to find out appropriate conclusions from the given statements. Apply the logical implications and also the negations of various connectives to find the solutions. Analyze the data and represent in the form of Venn diagrams to find relations between any given set of elements.
20UC2204	Corporate Communicatio n Skills	CO1	Verbal ability
		CO2	Soft skills
		CO3	Quantitative aptitude
		CO4	Reasoning
20UC3005	Aptitude Builder I	CO1	Apply the strategies and techniques for conversations in different contexts. Analyze the different parameters and formats of written technical communication and apply in everyday work and life.
		CO2	Analyze the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.
		CO3	Apply the concepts of Ratio & Proportion, Percentages, Profit &Loss, Simple & Compound Interest
		CO4	Analyze the series of numbers or letters to predict the next number in the series or to find the analogy. Analyze the data to find the codes in the process of encoding and decoding. Apply the given set of conditions to select a team from a group of members.
20UC3006	Aptitude Builder II	CO1	Apply the strategies and techniques for conversations in different contexts. Analyze the different parameters and formats of written technical communication and apply in everyday work and life.
		CO2	Analyze the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.
		CO3	Apply the concepts of Ratio & Proportion, Percentages, Profit &Loss, Simple & Compound Interest
		CO4	Analyze the series of numbers or letters to predict the next number in the series or to find the analogy. Analyze the data to find the codes in the process of encoding and decoding. Apply the given set of conditions to select a team

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			from a group of members.
20UC0007	*Indian Heritage and Culture	CO1	To familiarize with various aspects of the culture and heritage of India through ages.
		CO2	To acquaint with the contributions of Indians in the areas of languages and literature, religion and philosophy
		CO3	To understand the Social structure and the spread of Indian culture abroad
		CO4	To know the development of Science and Technology in India through ages and to appreciate the contributions of some of the great Indian scientists
20UC0008	*Indian Constitution	CO1	To understand Constitutional development after Independence
		CO2	To learn the fundamental features of the Indian Constitution
		CO3	To get a brief idea of the powers and functions of Union and State Governments
		CO4	To understand the basics of working of Indian Judiciary and the Election Commission
20UC0009	*Ecology & Environment	CO1	Understand the importance of Environmental education and conservation of natural resources.
		CO2	Understand the importance of ecosystems and biodiversity.
		CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process.
20UC0010	*Universal Human Values & Professional Ethics (online)	CO1	Understand and identify the basic aspiration of human beings
		CO2	Envisage the roadmap to fulfill the basic aspiration of human beings.
		CO3	Analyze the profession and his role in this existence.
20UC0011	*Entrepreneur ship	CO1	Learn critical elements of entrepreneurship and its development from institution's perspective
		CO2	Understand the process of entrepreneurship and its eco system in an educational institute to fit in entrepreneurship zone
		CO3	Understand & Learn Design Thinking skills towards product innovation & prototype design
		CO4	Learn the essential component of planning a new startup, including a. Recognizing viable market opportunities & Market

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			assessment via secondary market research and customer discovery via primary market research b. Creating a profitable business model and an executable business plan c. Protecting the intellectual property at the heart of their technology company d. Developing financial projections that are aligned with the proposed business plan
		CO5	Study the practices of working with Co-students in other discipline, integrating creative business strategies with solid engineering and effectively working in multi disciplinary teams
		6	Recognize the methods of making decisions in highly uncertain and unstructured environments to take feedback from a large variety of sources that use it to improve their business
			plans, or help them to 'pivot' and find alternative ideas or approaches
20MT1101	Mathematics for Computing	CO1	Apply matrix algebra to the real-world applications in engineering, physical and biological sciences, computer science, finance, economics and solving the system of equations.
		CO2	Apply basic and computational techniques on discrete structures like relations, orders, functions & FSM, Lattices, and propositional &predicate logic
		CO3	Apply graph theory to solving real world structures and their related applications.
		CO4	Apply Statistical methods to solving the real-world applications in Engineering science, Economics and Management.
		CO5	Apply basic concepts of Aptitude and Reasoning to solve engineering and real world problems (Tests in skilling hours)
21MT2102	Mathematics for Engineers	CO1	Apply differential and integral calucullus to find maxima and minimum of a functionctions.
		CO2	Demonistrate the forier series and Laplace transforms.
		CO3	Describe the probability , randam variables and Distributions
		CO4	Explain the complex variables analytic
21BT1001	Biology for Engineers	CO1	Acquire the Knowledge of basic biology
		CO2	Acquire the Knowledge of Human Biological Systems
		CO3	Acquire Knowledge on Microorganisms and Biosensors

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20UC1102	Design Thinking and Innovation I	CO1	Understand the basics of design thinking and its implications in product or service development
		CO2	Understand and Analyse the requirements of a typical problem
		CO3	Plan the necessary activities towards solving the problem through ideation and prototyping
		CO4	evaluate the solution and refine them based on the customer feedback
20UC1203	Design Thinking and Innovation Ii	CO1	Understand the basics of design thinking and its implications in product or service development
		CO2	Understand and Analyse the requirements of a typical problem
		CO3	evaluate the solution and refine them based on the customer feedback
SCIENCE ELECTIVE-1			
21PH1008	Physics for Electronic Engineers	CO1	Ability to understand classification of solids based on their Energy Bands.
		CO2	Ability to understand the conducting and semiconducting properties of solids at the microscopic level.
		CO3	Ability to understand the dielectric properties of materials at the microscopic level and their applications.
		CO4	Ability to understand the magnetic interactions in materials and the applications.
		CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects
21PH1004	Solid State Physics	CO1	Understands spin and orbital motion of electrons in determining magnetic properties of materials and identifies their role in classification soft & hard magnetic materials having specific engineering applications.
		CO2	Understands role of molecular level vibrations in determining thermal properties of materials, heat treatment methods for changing the microstructure of materials and micro and macro level responses of materials subjected to load,
			for identification of materials having specific engineering applications.
		CO3	Understands the role of electronic energy band structures of solids in governing various electrical and optical properties of materials.
		CO4	Understands the role of electronic energy band structures of solids using various models, classification of materials based on their band structures and their properties

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		CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects.
SCIENCE ELECTIVE-2			
21CY1101	Engineering Chemistry	CO1	Demonstrate different types of semiconducting materials
		CO2	Illustrate photo-physical basis of light absorption and emission by materials
		CO3	Sketch the underlying principles of organic light emitting diodes
		CO4	Explain the concepts of solar cells modules and memory devices
		CO5	An ability to apply and generate experimental skills
21CY1004	Organic Electronics	CO1	Explain the concepts of solar cells modules and memory devices
		CO2	An ability to apply and generate experimental skills
ENGINEERING SCIENCES			
20SC1101	Computational Thinking for Design	CO1	Design basic and complex building blocks for real world problems using structured programming paradigm
		CO2	Apply computtaional thinking into logic design for solving real world problems
		CO3	Apply CRUD operations on basic data structures
		CO4	Apply CRUD operations on linear data structures
		CO5	Apply the structured programming paradigm with logic building skills on basic and linear data structures for solving real world problems
20SC1202	Data Structures	CO1	Apply measures of efficiency on algorithms and Analyse different Sorting Algorithms.
		CO2	Analyse and compare stack ADT and queue ADT implementations using linked list and applications.
		CO3	Analyse the linked implementation of Binary, Balanced Trees and different Hashing techniques.
		CO4	Analyse different representations, traversals, applications of Graphs and Heap organization.
		CO5	Develop and Evaluate common practical applications for linear and non-linear data structures.
20ME1103	Design Tools Workshop - I	CO1	Design a product using 3D modeling in Auto Desk Fusion 360 through the concept of Engineering Design Process.
		CO2	Design of static webpages using HTML5 and CSS.
		CO3	Apply the concepts of Latex in writing the reports.

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		CO4	Apply visualization techniques in creating data visualization dashboards with tools like Power BI.
21SC1209	Design Tools Workshop - II	CO1	Demonstrate the design ideology by 3D printing, 3D scanning techniques
		CO2	Illustrate the design ideology by incorporating VR technique and VR technology, Visualize and present his design idea by applying AR technique and Hologram
		CO3	Summarizing PCB technology and their applications
		CO4	Demonstrate Arduino based skill with different interfaces
20SC1203	Object Oriented Programming	CO1	Understand basic Concepts of OOP, fundamentals of java and apply the concepts of classes and objects through Java Language. Apply constructors, Overloading, parameter
			passing.
		CO2	Apply access control, Inheritance, Packages.
		CO3	Apply Interfaces, Exception Handling, multi-threading, I/o
		CO4	Apply collection framework and event driven programming.
		CO5	Apply object-oriented programming concepts to write programs and Analyses requirements and design to implement lab-based project with SDLC in a group of students.
21EC1101	Digital Logic & Processors	CO1	Understand the structure of a digital computer and design combinational circuits for processor using the principles of Boolean Algebra and gates
		CO2	Analyze the operation of latch/flip-flop and design timing and sequence control circuits using flip-flop
		CO3	Apply the programmable logic and design digital circuits using Programmable logic devices
		CO4	Apply the minimization techniques and Construct optimized combinational and sequential logic circuits
		CO5	Design of combinational and sequential circuits with logic gates and flip-flops with a verification using Logisim and Verilog HDL tool
20EC1202	Computer Organization & Architecture	CO1	Able to understand the computer organization and architecture through Arithmetic and logic unit,
			system bus, addressing modes and instruction set
		CO2	Apply the concept of arithmetic and logical unit in CPU design and memory mapping techniques like direct mapping, Associate and block set associate mapping in Cache memory

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		CO3	Apply the concepts of the DMA controller and I/O transfer techniques in data transfer betwwen peripharals and processor
		CO4	Analyze pipelining operation in instruction execution and parallel computing architectures to speed up program execution
21EC1213	Design of Basic Electronics and Circuits	CO1	Analyze the V-I relations of different passive circuit
			elements
		CO2	Apply different circuit analysis techniques on practical circuits.
		CO3	Analyze the V-I relations of different active circuit elements.
		CO4	Identify the practical circuits comprising semi conductor devices.
21EC2111	Electronic System Design Workshop	CO1	Analyse the Analog and Digital electronic systems and their impacts on the performance
		CO2	Design PCB art -work by following PCB design rules using the Software and learning about fabrications, packaging and EMI/EMC issues
		CO3	Apply the Raspberry Pi microcontroller to design an embedded system for
			modern electronic system design
		CO4	Analyse the Electronic Circuits for the noise reduction designs in components and circuits, high frequency designs and CAD packages
		CO5	Design the different Electronic Circuits and Develop with PCB FABRICATION techniques and also design an embedded system using raspberry Pi to demonstrate for social problems.
21EC2214	IoT Workshop	CO1	Demonstration of various Sensors both Analog & Digital for IoT Applications
		CO2	Applying & Interfacing various micro controllers with IoT: Micro controllers boards, ESP8266, Peripherals (Motors, Camera, Speaker, Displays), Controlling through Mobile & Web
		CO3	Analyze different protocols with IoT Data Communication: Wi-Fi Protocols, Bluetooth, BLE, WSN, Zigbee, RFID, NFC, Client Server, Cloud.
		CO4	Examine the various Protocols & Case Studies : Issues & Challenges : Security, Privacy, Scalability, Store and Analytics Case Studies: Health, Smart cities, Village/ Agriculture
		CO5	Design and develop various mini projects using Node MCU, ESP 32 and Raspberry Pi for various applications.
21EC2112	IT Workshop	CO1	Apply the knowledge of HTML coding for

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			designing the web page
		CO2	Apply the basic concepts of Arduino Interfacing to develope Native apps for Android Phone.
		CO3	Apply the concepts of interfacing the Raspberry Pi
			board with Web-App, and develop similar applications for Mobile App
		CO4	Develop a Project using Raspberry pi for Web Apps or Mobile Apps
		CO5	Design the projects based on HTML, XML, and Arduino Uno Boards.
PROFESSIONAL CORE COURSES			
21EC2103	Analog Electronic Circuit Design	CO1	Analyze the operation of electronic devices like transistors and illustrate their electronic behaviour using Multisim.
		CO2	Distinguish linear and nonlinear circuits using lumped elements and analyze their response using Multisim
		CO3	Interpret feedback in amplifiers and realize them through lumped element circuits and linear ICs
		CO4	Design various electronic circuits using linear ICs and demonstrate their applications using Multisim
		CO5	Design Analog circuits for realistic applications and demonstrate it through a mini-project
21EC2104	Communicatio n Signals & System Design	CO1	To Interpret and analyse different types of signals and perform various operations on them.
		CO2	To make use of transforms in the analysis of signals and systems.
		CO3	To utilize properties and operations of signals for analysing the effects in the various communication systems.
		CO4	To develop the foundation of signal processing for communication and analyse with system design.
21EC2105	Analog and Digital Communication	CO1	Apply time and frequency analysis techniques to Analog modulation systems.
		CO2	Analyze different digital modulation techniques.
		CO3	Analyze digital carrier ,signaling techniques with baud rate considerations.
		CO4	Analyze different switching techniques and real time signalling systems.
		CO5	Design and analyze analog and digital communication circuits through project based learning using modern tools.
21EC2106	Embedded Controllers & Embedded	CO1	Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of 8086

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	Systems Design		microprocessor & 8051 Microcontroller.
		CO2	Analyze the Interfacing of Peripherals to the 8051 Microcontroller through programming & Apply the basic architectures of PIC and ATMEGA 32
			Microcontrollers.
		CO3	Apply the concepts of ARM - CORTEX STM-32 Microcontroller and RTOS
		CO4	Apply the concepts of SoC and Modern Microcontroller Boards key Features, Specifications & Applications.
		CO5	Analyze the applications of programming with 8051, 8086 and Arduino on hardware / software.
21EC2207	Electromagnetic Fields & Applications	CO1	Apply the principles of vector calculus and static feilds to estimate the static electric feilds and magnetic feild due to different sources
		CO2	Develop the boundary conditions on E, H Feilds and extend the concepts to obtain the governing laws of electromagnetic feild that helps to percieve the wave propagation
		CO3	Analysis of different electromagnetic feild applications
		CO4	Analyse different advanced electromagnetic feild applications
21EC2208	Digital Signal Processing	CO1	Develop DFT and apply that to analyze signals in the frequency domain
		CO2	Construct IIR filters for filtering operation
		CO3	Construct FIR filters and find solutions for filtering problems
		CO4	Analyse the multi-rate signal processing concepts
		CO5	Develop signal processing algorthems in software and apply them to finding solutions to real time problems
21EC2209A	Statistics, AI, ANN	CO1	Apply the concepts of probability and distributions to analyze engineering
			problems.
		CO2	Discover the relationship between statistics and machine learning and illustrate their usefulness in AI.
		CO3	Categorize the various searching techniques and employ them for finding optimal solutions to AI problems.
		CO4	Examine the neural network based models and test their learning capabilities in classification tasks.
21EC2209	Introduction to	CO1	Describe the basics of Probability, statistics and

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	AI, ANN Tools & Applications		apply them in engineering applications.
		CO2	Analyze the AI applications and identify the usefulness in real world problem solving.
		CO3	Formulate the concepts of AI searching techniques and ANN models to solve basic
			problems.
		CO4	Develope and synthesize AI and ANN Models for real timeapplications.
21EC2210	Data Networks and Protocols	CO1	Interpret the basic network structure, software and models, device and applications
		CO2	Analyse the error detection and correction techniques in link layer protocols with cisco packet tracer
		CO3	Design and analyse different routing algorithms and network layer protocols
		CO4	Design and analyse transport and application layer protocols
		CO5	Design of different networking protocols using simulation
FLEXI COURSES			
21EC3015	VLSI Design	CO1	Apply the voltage biasing techineques to analyze MOS charecteristics
		CO2	Analyze the Pull up -pull down scaling ratios for MOS inverters
		CO3	Build MOS logic circuits using design rules
		CO4	Examine MOS circuit performance and faults using testing principles
		CO5	Develop MOS circuits and logic testing techniques
21EC3016	Wireless Communicatio ns	CO1	Apply the wireless communciation concepts to interpret cellular architecture
		CO2	Analysis of different fadding mechanisims in mobile communications
		CO3	Analyze the equalization and diversity techniques in wireless communications
		CO4	Analyze GSM architecture, frame format other wireless communication technologies such CDMA, IEEE 802.11, 4G and OFDM systems.
		CO5	Implement wireless fading channels and apply the concept of diversity and
			equalizer to evaluate signal reception performance in the presence of wireless channel using communication software tools
21EC3017	RF System Design	CO1	Apply smith chart to analyze the impedence measurement for various passive RF devices.
		CO2	Design and analyze RF filters
		CO3	Design and analyze RF amplifiers and oscillators

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		CO4	Analyse the design considerations of different real-time applications
		CO5	Design and analyze different RF amplifers, oscillators and other applications using HFSS
21EC3018	Biomedical Electronics & IOT for Healthcare	CO1	Apply the bio- signal characteristics, measure the electrical activity of heart, brain, muscles and determine the non electrical parameters.
		CO2	Demonstrate the working and significance of Medical Instruments in health care applications.
		CO3	Analyze various IOT sensors for Healthcare as a next generation boon for Electronics.
		CO4	Analyze the various IOT health care monitoring devices.
		CO5	Design,simulate and test bio signal characteristics and IoT applications for health care.
21EC3019	Electronics Instruments & Automation	CO1	Demonstrate the characteristics of Electronics instruments and their Measurements and apply them to copute measurements.
		CO2	Explore the fundamentsl design concepts of Electronic Measuring Instruments and discover their usage in real time environment.
		CO3	Describe the importance of Control Systems in Automation to construct a robotic systems with desired response.
		CO4	Analyze the industrial automation based applications and summarize their advantages in sustinable developement.
		CO5	Synthesize various electronic instruments and control systems for automation.
21EC3020	System Engineering, Operation Research & Designing	CO1	Illustrate system design concepts and analyze their functionality.
		CO2	Apply operational research methodology and solve linear programming problems.
		CO3	Analyze finite queuing models and examine their applications in gaming theory.
		CO4	Analyze the design concepts in UI, UX and product design.
		CO5	Construct and combine operational research methodologies in systems engineering.
21EC3021	Electrical Technologies & Solar Power Systems	CO1	Interpret the basics of electrical technologies on electrical circuits, motor and generators.
		CO2	Analyse the concepts of power generation, transmission, and distribution on commercial systems and modern distribution systems.
		CO3	Analyse the utilization of electrical smart grids on the existing electric grids using modern systems
		CO4	Apply the basic concepts of photovoltaic systems on the design of solar power system

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		CO5	Design and development of electrical circuits, power systems and analysis of solar photovoltaic systems
21EC3022	Advance Course IN Soft-Computing (AI, ANN, Fuzzy Logic & Genetic Algorithms)	CO1	Describe the fundamentals of AI and interpret them for
			solving real world problems
		CO2	Construct the machine learning techniques and demonstrate their use in pattern recognition.
		CO3	Formulate data dimensionality reduction problems and demonstrate their use for AI applications with large databases.
		CO4	Recognize optimization and fuzziness in finding solutions to AI problems and demonstrate their approaches.
		CO5	Develop and synthesize AI concepts for classification, prediction, optimization and regression applications by generating performance analysis reports.
LIST OF PROFESSIONAL ELECTIVES			
21EC3051	Wireless sensor Networks & IOT Applications	CO1	Understanding of wireless sensor network technologies
		CO2	Study of BLE protocols in WSN security and power
			applications.
		CO3	Study and application of IOT and WSN for smart cities/ villages.
		CO4	Study of various IoT application in various domains
21EC3052	Solar Photo-Voltaic cells & Solar Power Arrays	CO1	Apply the fundamentals, structure, and characteristics of photovoltaics to test the performance of the solar cell.
		CO2	Analyze the SPV materials and production of SPV cells with different methodologies
		CO3	Apply design concepts and develop the reliable SPV with testing and optimization techniques.
		CO4	Analyse the SPV arrays, configurations with AI and ML.
21EC3053	Electronic Systems for Renewable Energy & Smart Grid	CO1	Apply the concept of Renewable Energy with solar power and electronic power converters.
		CO2	Apply the electronics system concept for renewable energy sources with different sensors and data management.
		CO3	Analyse the Concept of smart grid sub system and circuits
		CO4	Analyse Smart grid to IOT applications with smart grid security, communication and power system
21EC3054	IOT Applications for	CO1	Understand the basics of smart cities/villages/living

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	Smart Cities	CO2	Study of systems for smart cities with case studies.
		CO3	Analysis and design of smart grid sub-systems and circuits
		CO4	Study of advanced topics related to privacy, scaling and design considerations.
21EC3055	Systems for Smart Cities & Smart Villages	CO1	Understanding the systems and smart systems with local requirements issues and solutions
		CO2	Study of System for smart villages with different
			modules of smart villages with privacy and security
		CO3	Study of System for smart cities with different management modules of smart cities.
		CO4	Understanding the next generation needs for smart Systems and Smart Global System.
VLSI			
21EC3061	Low Power VLSI	CO1	Understand the power dissipation in MOS structure
		CO2	Illustrate probabilistic power analysis and apply low power techniques at circuit level for CMOS circuits
		CO3	Apply low power techniques for various combinational circuits.
		CO4	Design and analysis of low power techniques for memories.
21EC3062	Algorithms for VLSI Design Automation	CO1	Understanding of computational and automation tools
		CO2	Understanding of VLSI layout modeling
		CO3	Understand and analysis of hardware models
		CO4	Analysis and understanding the FPGA technologies
21EC3063	ASIC and FPGA Chip Design	CO1	Study and design of combinational and sequential circuits using PLDs and state machines.
		CO2	Understand Full-custom & Semi Custom design methodologies of for designing different PLD architectures.
		CO3	To study PLD structures and design process. Study of different CPLD and FPGA architectures
		CO4	To understand different physical process.
21EC3064	VLSI Sub-system Design and Design for Testability	CO1	Understand the design flow and methodologies of VLSI sub-system
		CO2	Study of memory and array sub systems
		CO3	Analysis of fault tolerant
			designs
		CO4	Design of testing of VLSI systems
21EC3065	Semiconducto r Memories &	CO1	Demonstrate the basics of non-volatile memories and its applications

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	MEMS	CO2	Interpret the advanced random access memories and few basics of solar cells and supercapacitors
		CO3	Apply the concepts of micro machining process to MEMS Devices
		CO4	Analysis the memory fault models and testing process
21EC3066	Analog & Digital IC Applications	CO1	Revisit the Basic functionality and Electrical Properties of MOS Devices and apply the properties to determine the gain of amplifiers
		CO2	Perform analysis on passive & active current mirrors and switched capacitor technique.
		CO3	Illustrate design procedure of static and dynamic CMOS
			circuits and sequential logic gates and clock synchronization to design an efficient circuit for the given logic
		CO4	Illustrate the design procedure of arithmetic building blocks and memories.
AUTOMATION & ROBOTICS			
21EC3071	Control Systems & Introduction to Robotics	CO1	Apply the concepts of control systems and analyse their static and dynamic conditions
		CO2	Apply the time, frequency analysis and system design.
		CO3	Analyse the components of robotic systems and apply to construction of simple robots.
		CO4	Apply the fundamentals of kinemetics to analyze the dynamic control in robotic design.
21EC3072	Autonomous Vehicles & Automotive Electronics	CO1	Apply the foundations of autonomous vehicle
			technologies and its basic terminologies
		CO2	Analyze the essential principles of sensors and actuators used for automotive
		CO3	Discover the fundamental principles of automotive electronic control systems
		CO4	Illustrate the case studies on autonomous vehicles and automotive electronics.
21EC3073	Advanced Robotics	CO1	Apply the fundamentals of robotic sensors and motions in robotics
		CO2	Analyse the position and displacement of joints for different input conditions.
		CO3	Illustrate different robotic mechanisms and describe their usefulness in automation.
		CO4	Demonstrate specific case studies with respect to robotic applications
21EC3074	Computer Vision & Applications	CO1	Examine the fundamental concepts related to multi-
			dimensional signal processing and describe their usefulness in computer vision applications.

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		CO2	Inspect various image representation models and examine their characteristics.
		CO3	Analyze various motion estimation models in video data and critisize their performance.
		CO4	Illustrate various machine learning models for computer vision applications and test their perfromance.
21EC3075	Human Machine Interface & Brain Machine Interface	CO1	Interpret the fundamental concepts of Human-Machine Interfaces and analyze their usefulness in interactive system design.
		CO2	Apply the knowledge generated in the development of HCI models and illustrate their design pardigrams.
		CO3	Analyze the brain control interface models and
			categorize their importance in understanding human performance.
		CO4	Interpret the BCI/HMI application designs and estimate their value in real world machine interactions.
21EC3076	Designing Automation Systems & Assistive Robotic Systems	CO1	Analyze fundamental building blocks for automated system development and show design parameters.
		CO2	Interpret the design processes for building home automation systems and formulate the entire end-to- end system configurations.
		CO3	Analyze the methods developed for the efficient utilization of industrial robots and examine their effectiveness in various industrial domains.
		CO4	Illustrate the application of robotics for human assistance and show the parameters required for designing assistive
			technologies.
SIGNAL PROCESSING			
21EC3081	Speech Signal Processing	CO1	Apply Speech signal parameters to modal and classify distinguish Speech signal
		CO2	Apply diversified Signal Processing approaches to represented Speech Signal
		CO3	Apply and Analyze various signal processing approaches to represent various Speech signal
		CO4	Employ statistical methods and ANN for Speech signal processing with software tool
21EC3082	Digital Image Processing	CO1	Interpret the fundamental concepts of digital image processing and apply then to generate reviews on some key applications
		CO2	Develop 2D Transform models for analysing images in frequency domain and
			evaluate their capabilities.

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		CO3	Develop restoration, segmentation and filtering algorithms on degraded images and list their efficiencies.
		CO4	Develop compression models and examine their performance for data transmission.
		CO5	Develope and modify various image processing algorithms.
21EC3083	Biomedical Image Analysis	CO1	Describe imaging techniques applied to biomedical studies and summarize their usefulness in diagnostics.
		CO2	Apply image processing mechanisms to derive features on biomedical images and discover performance metrics.
		CO3	Analyze the extracted features from biomedical images and categorize them with respect to usefulness in
			automation.
		CO4	Discover important existing real time biomedical image analysis tools and explain their design processes.
21EC3084	Statistical Signal Processing	CO1	Apply statistical signal models and their properties in the analysis of signals using Stochastic processes
		CO2	Design of optimum filters using classical and adaptive algorithms to extract the signals in the noisy environment.
		CO3	Develop various spectral estimation techniques for achieving higher resolution in the estimation of power spectral density
		CO4	Analyze the Kalman and extended Kalman filters in the design of optimum filters
21EC3085	Adaptive Signal Processing	CO1	Apply the fundamental concepts of adaptive systems and identify the critical design parameters.
		CO2	Employ the Searching performance surface stability and rate of convergence parameters for describing adaptive systems.
		CO3	Apply the concepts of learning models and compare their performance in 1D domain.
		CO4	Illustrate the applications of adaptive systems and categorize their design processes.
21EC3086	Detection and Estimation of Signals	CO1	Apply the fundamental directions in the design and analysis of signal detection and estimation.
		CO2	Employ statistical decision theoretical models and test their performance on multiple signal types.
		CO3	Analyze the algorithms in signal estimation and describe the properties of a signal estimatior.
		CO4	Describe the importance of state estimation in various

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			applications and report the process flow models.
21EC3087	Biomedical Signal Analysis	CO1	Describe various sources of biosignals and identify their properties for signal analysis.
		CO2	Analyze the signals obtained from bio instruments and apply signal processing methods to extract useful information.
		CO3	Review modern medical instruments and report their capabilities in enhancing health profiles.
		CO4	Apply advanced signal processing methods in improving the abilities of the existing models and test them.
RF AND MICROWAVE			
21EC3091	Microwave Engineering	CO1	Analysis of different microware components and devices
		CO2	Apply S parameters and Analysis of differnt
			microware components
		CO3	Apply S parameters and Analysis of microwave filters and periodic structures
		CO4	Interpret the applications of microwave and millimetric wave circuits
21EC3092	Antenna Design & Wave Propagation	CO1	Apply the radiation concept and Analyze of different antennas
		CO2	Analyze the various antenna types and arrays
		CO3	Analyze the VSWR and Impedance measurements for different antennas
		CO4	Interpret real-world applications of various antennas.
21EC3093	Radar Engineering & Navigational Aids	CO1	Apply the basic principles of communications to build a radar system
		CO2	Analyze the MTI radars
		CO3	Analyze different radar systems
		CO4	Understand the principles Navigation system
21EC3094	Modern Antennas, Millimeter Waves & Applications	CO1	Understand and analysis of modern antenna design
		CO2	Apply the concepts of mm waves for meteorological applications.
		CO3	Design and analyze mm wave circuits.
		CO4	Analyze the applications of modern antennas and mm wave radar.
21EC3095	Electronic Warfare, EMI & EMC	CO1	Understand the basic concept of Electronic Warfare
		CO2	Intrepret the different Jamming techniques and its methodologies
		CO3	Interpret the concept of design of EMC and components
		CO4	Analyse, design and testing of EMI and EMC
DATA COMMUNICATION			

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21EC4051	Information Theory & Coding	CO1	Analyze different statistitcal models for information
			theory and coding
		CO2	Analyze differnt coding methodologies for measuremnt of information
		CO3	Analysis of various error detection and correction techniques
		CO4	Analysis of various Error detection and correcting using state diagrams
21EC4052	4G Wireless Technologies and Cellular Communicatio n	CO1	Analysis of Spreading Sequences and Multi-user systems
		CO2	Analysis of Multi-carrier Communication Systems
		CO3	Analysis of Multi-user communciaion systesm
		CO4	Interpet various Advanced cellular communications and allied topics
21EC4053	Satellite Communicatio ns	CO1	Apply basic concepts of communications to satellite communication
		CO2	Apply the spectrum analysis concept and Analyze the Satellite Link Design and budget
		CO3	Analysis of Multiple Access Techniques
		CO4	Analysis of global navigation systems
21EC4054	Optical Communicatio n and Network	CO1	Apply fundamental laws of optics and Analyse different optical fiber waveguide types
		CO2	Analyze different optical sources, materials and structures
		CO3	Evaluate different optical network protocols against network performance
		CO4	Apply the network principles and Analyze the different optical networks
21EC4055	Next Generation Wireless Technologies	CO1	Apply wireless communication techniques to analyze 5G New Radio
		CO2	Apply Massive MIMO for 5G and Beyond 5G
		CO3	Analysis of Millimeter wave Communications
		CO4	Design and Evaluate Vehicular Communications and other Advanced Topics
21EC4061	TCP/IP & Other Protocol Suite	CO1	Analyse addressing techniques and troubleshooting protocols
		CO2	Design and Analyze DHCP for development of different networks
		CO3	Design and analyze DNS for development of different networks
		CO4	Analyse congestion control protocols with case studies
21EC4062	VoIP Systems & Broad Band Networks	CO1	Apply the networking knowledge to interpret the legacy technology of classical telephony
		CO2	Analyse different unicast routing protocols
		CO3	Analyse different VoIP protocols and codecs

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		CO4	Apply NAT techniques and Analyse the quality of service for networks with SIP protocol
21EC4063	5G Mobile, Wireless Technologies & IEEE 802 Standards	CO1	Evolution of LTE beyond 4G and 5G and analyze the architectures of 5G and IoT for real-time applciations
		CO2	Analysis of radio access technologies for 5G
		CO3	Analysis of multi-hop and multi-carrier systems for 5G
		CO4	Interpret various IEEE standards
21EC4064	Cloud-Computing & Network Security	CO1	Apply cloud network basics for network virtualization
		CO2	Analysis software fabric architecture and cloud data center networks and standards
		CO3	Apply cloud computing techniques for establishment of network and data center security
		CO4	Analysis of various Network Security issues
21EC4065	IP Multimedia Sub-System & Emerging Technologies (Cloud, IOT, NFV, SDN)	CO1	Apply PSTN fundamendals to analyse IMS architecture
		CO2	Analyse IMS Protocol stacks and IMS operations
		CO3	Analyse IMS-PSTN and IMS services for GSM, Web-Msg, voice, VoLTE erc
		CO4	Interpret various Emerging Tech. of IMS
BIO-MEDICAL INSTRUMENTATION			
21EC4071	Automated Vehicles & Avionics	CO1	Apply fundamentals of automation in vehicular systems and review their functionalities.
		CO2	Illustrate the safety parameters in designing an autonomous vehicular system and demonstate the same using design principles.
		CO3	Apply digital communication technologies in vehicular automation and show their effectiveness in real-time scenarios.
		CO4	Outline the fundamental concepts in avionics and report design functionalities.
21EC4072	Calibrations and Designing Advanced Instruments	CO1	Apply the knowledge of measuring instruments and show their usage in on-field measurements.
		CO2	Analyze the evolving design parameters of measuring instruments and evaluate the
			changes with respect to upgrading technologies.
		CO3	Apply instrument calibration methods and discover the impact of parameter relationships during the process.
		CO4	Analyze the new approaches introduced in the design of instruments and examine various parameters required for improving reliability.
21EC4073	Biological & Cyber- Physical Systems	CO1	Apply the functionality of basic instruments used in cyber-physical systems and report their characteristics across applications.

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		CO2	Analyze application fields of cyber-physical systems and demonstrate the process flow maps used in them to extract sustainablility.
		CO3	Apply the usefulness of biological models in formulating digital systems and examine their impact on designing learning algorithms.
		CO4	Apply the knowledge of the application pipelines and report the design and performance parameters.
21EC4074	Electronic Instruments & Biomedical Applications	CO1	Illustrate the fundamental processes in the design of electronic measuring instruments and show their usage in sensing signals.
		CO2	Analyze the procedures followed in enhancing communication between components and report their effectiveness across instruments.
		CO3	Analyze the performance of the instrument developed using bio-inspired electronics and discover the relationships.
		CO4	Illustrate the applications of biomedical electronics across multiple domains and compare their design aspects.
21EC3072	Autonomous Vehicles & Automotive Electronics	CO1	Apply the foundations of autonomous vehicle technologies and its basic
			terminologies
		CO2	Analyze the essential principles of sensors and actuators used for automotive
		CO3	Discover the fundamental principles of automotive electronic control systems
		CO4	Illustrate the case studies on autonomous vehicles and automotive electronics.
21EC3075	Human Machine Interface & Brain Machine Interface	CO1	Interpret the fundamental concepts of Human-Machine Interfaces and analyze their usefulness in interactive system design.
		CO2	Apply the knowledge generated in the development of HCI models and illustrate their design pardigrams.
		CO3	Analyze the brain control interface models and categorize their importance in understanding human performance.
		CO4	Interpret the BCI/HMI application designs and estimate their value in real world machine interactions.

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