Koneru Lakshmaiah Education Foundation
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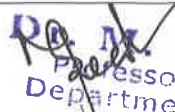Department of Electronics and Communication Engineering
Program: B.Tech -ECE
Academic Year : 2018-19

Course Code	Course Name	CO No.	Description of the Course Outcome
HUMANITIES & SOCIAL SCIENCES			
18UC1101	BASIC ENGLISH	CO1	Apply the practical knowledge of using action words in sentence construction.
		CO2	Apply and analyze the right kind of pronunciation with regards to speech sounds and able to get different types of pronunciations.
		CO3	Apply the concept of fundamental principle of counting to solve the problems on linear, circular permutations and also for the problems on selections. Apply the concept of probability, while doing the problems on Leap year & Non-Leap year problems, coins, dice, balls and cards.
		CO4	Analyze the given conditions and finding out all the possible arrangements in linear & circular order. Analyze the given numbers or letters to find out the hidden analogy and apply that analogy to find solutions. Finding the odd man out by observing the principle which makes the others similar.
18UC1202	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
18UC2103	PROFESSIONAL COMMUNICATION 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

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			problems related to average speed, 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.
18UC2204	APTITUDE BUILDER-I	CO1	Apply the concept of Critical Reading and Analytical Reading and comprehend the key ideas and gist of a passage. Understand the importance of the presentation skills, analyze the given topic, apply various strategies and the principles of grammar in written expression.
		CO2	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.
		CO3	Apply the concepts of Numbers to solve the problems related to divisibility rules, problems based on Unit's digit, Remainders, Successive Division, Prime Factorization, LCM & HCF problems. Apply the concepts of Averages & Allegations; students will be able to solve the problems related to Averages as well as problems based on Mixtures.
		CO4	Apply the various concepts of cubes to find out how to cut a cube to get the maximum number of smaller identical pieces, how to minimize the number of cuts required to cut a cube into the given number of smaller identical pieces, how to count the number of smaller cubes which satisfy the given painting scheme. Apply the principles of binary logic to solve problems involving truth-tellers, liars and alternators. Analyze the given data to form an ordered arrangement from an unorganized raw data.
18UC3105	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 from a group of members.
18UC3206	CAMPUS TO CORPORATE	CO1	Analyze basic concepts of critical and analytical reasoning skills apply strategies analyze issues, arguments, and some aspect of corporate communication.
		CO2	Creativity in writing of any given context like sending

			Emails, Reports, Proposals etc. Make the student to face HR interviews.
		CO3	Enable the students to decipher the meaning of the context in the given texts. It also helps students to develop critical thinking.
		CO4	Comprehension passages assist in developing writing skills and in grooming them to be ready for placements.
18UC0007	*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
18UC0008	*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
18UC0009	*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.
		CO4	Understand the importance of Environmental education and conservation of natural resources.
18UC0010	*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.

BASIC SCIENCES

18SC1103	Single Variable Calculus and Matrix Algebra	CO1	Model the physical laws and relations mathematically as a first order differential equations, solve by analytical and numerical methods also interpret the solution.
		CO2	Model physical laws and relations mathematically as a second/higher order differential equations, solve by analytical method and interpret the solution.
		CO3	Obtain the Fourier series expansions of periodic functions and use the series to solve ordinary differential equations.
		CO4	Model physical problems mathematically as a system

			of linear equations and solve them by analytical and numerical methods. Also, determine the nature of Quadratic form using Eigen values.
18MT1201	Multivariate Calculus	CO1	Determine extreme values for functions of several variables
		CO2	Determine area, volume moment of inertia through multiple integrals in Cartesian or polar co-ordinates.
		CO3	Apply the concepts of vector calculus to calculate the gradient, directional derivative, arc length, areas of surfaces and volume of solids in practical problems
		CO4	Obtain analytical and numerical solutions of Heat and wave equations
		CO5	Verify the solution of problems through MATLAB
18SC1105	Logic and Reasoning	CO1	Understand how to use Venn diagrams to find the conclusion of statements, solve puzzles using binary logic.
		CO2	Understand to solve problems on clocks, calendars and problems on Non verbal reasoning.
		CO3	Understand the available models for Venn diagrams with given data, solve problems relating to cubes and number and letter series.
		CO4	Understand the techniques used to solve problems puzzles using analytical reasoning on coding and decoding and blood relations
18SC1104	Foundations of Computational Mathematics	CO1	Identify the quantities of Real world problems by using the concepts of arithmetic.
		CO2	Computing the areas of regular and irregular solids of real world problems.
		CO3	Identifying the numbers by successive division also finding the solution of equations.
		CO4	Estimating the roots of an equations and find the unknown values from the data by numerical methods
18BT1001	Biology for Engineers	CO1	Understand the basis of Life, Living organisms and human body systems
		CO2	Understand the importance of Diet and Nutrition
		CO3	Acquire the knowledge of beneficial and harmful Microorganisms and Biosensors
		CO4	Understand the importance of Biosensors

SCIENCE ELECTIVE-I

18PH1005	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
18 PH1004	SOLID STATE	CO1	Understands spin and orbital motion of electrons in

	PHYSICS		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
		CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects.
18PH2101	QUANTUM MECHANICS FOR ENGINEERS	CO1	Understand the need of Quantum Mechanics and mathematical formulations of equations.
		CO2	Understand the Wave function and its Physical properties.
		CO3	Understand the applications of Quantum Mechanics for some semiconducting components.
		CO4	Understand some simple Quantum Systems
		CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects.

SCIENCE ELECTIVE-II

18CY1001	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	Explain the concepts of solar cells modules and memory
18CY1003	Chemistry and Bio-Informatics for Engineers	CO1	Develop the current knowledge of materials and apply the characteristics, theories of materials in biomedical applications.
		CO2	Interpret the interaction of biomolecules with various bio electrodes and host responses to implants, including toxicity and health implications
		CO3	Relate genetics and modern DNA technology for disease diagnostics, therapy and drug design.
		CO4	Illustrate the application of chemistry, organic electronics in diagnostic and therapeutic area.
		CO5	Analyze the properties of the samples using analytical instruments which are useful for clinical analysis in health care, drugs and pharmaceutical laboratories.

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		CO1	Demonstrate different types of semiconducting materials
18CY1004	Organic Electronics	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

ENGINEERING SCIENCES

		CO1	Illustrate how problems are solved using computer programming
18SC1101	Problem Solving and Computer Programming	CO2	Illustrate use of control flow statement in C
		CO3	Interpret and illustrate user defined functions and different operations on list of data
		CO4	Implement Linear data structures and to compare them
		CO5	Apply and Knowledge obtained by the course to solve real world problems in laboratory
18SC1202	Data Structures	CO1	Apply measures of efficiency on algorithms ans analyse different sorting algorithms
		CO2	Analyze and compare stack ADT and Queue ADT implementations using Linked List and application
		CO3	Analyze the linked implemetation of Binary, balanced Trees and different Hashing techniques
		CO4	Analyze different representaions, Traversals, applications of Graphs and Heap organizations
18EC1002	Engineering Graphics & Design for Electronics and Computer Engineers	CO1	Describe some important design considerations in choosing a graphics for a specific application.
		CO2	Acquire knowledge on orthographic projection
		CO3	Examine projections of planes and solids
		CO4	Explain the role of curves and sections
		CO5	Analyze & generate PCB layout skills
18EE1003	Work Shop Practice for Electrical and Electronics Engineers	CO1	Prepare wooden Lap T, Plus joints. Prepare square and L fits. Fabricate parts made of sheet metal. Demonstrate the ability to execute stair-case lighting and go-down lighting house wiring connections
		CO2	Use arc welding equipment and tools to prepare butt joint for joining mild steel metal flats in a safe manner. Demonstrate the ability to melt and pour molten material into dies. Perform facing and plain turning on Lathe to prepare cylindrical jobs. Drill holes on Mild steel metal flats using drilling machine.
		CO3	Identify hardware components in a computer system, Assemble and disassemble a computer system, Install operating system and software
		CO4	Identify electronics components& soldering practice, connect identified computers in a network,
18CS2004	Object Oriented Programming	CO1	The student will be able to understand basic Concepts of OOP, fundamentals of java and apply the concepts of classes and objects through Java Language.
		CO2	The student will be able to apply constructors, Overloading, parameter passing, in Java programming.
		CO3	The student will be able to apply access control, Inheritance, Packages.

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		CO4	The student will be able to apply , Interfaces, Exception Handling	
		CO5	Students will be able to apply object oriented programming concepts to write programs.	
18EC1101	Digital System Design	CO1	Understand the principles of Boolean Algebra and apply them for simplification of Boolean Functions.	
		CO2	Construct various combinational logic circuits using logic gates for optimized performance.	
		CO3	Analyze the operation of latch/flip-flop and design different sequential circuits with minimum number of flip-flops and gates	
		CO4	Understand the importance of digital logic in Processors and Apply the reprogrammable logic principle for implementing various combinational and sequential circuits.	
		CO5	Design of combinational and sequential circuits with logic gates and flip-flops with a verification using Verilog HDL tool.	
18EC3110	Electronic Workshop-II (Electronic System Design Workshop)	CO1	Identify the Analog and Digital electronic systems and their impacts on the performance	
		CO2	Discuss 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.	
18EC2214	Electronic Workshop-III (IOT Applications)	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.	
18EC2115	IT Workshop-I (HTML, XML, WEB DESIGN)	CO1	Experiment with HTML/XML and Word press	
		CO2	Construct Arduino Interfacing and Mobile Apps (Native apps for Android Phone)	
		CO3	Experiment with interfacing the Raspberry Pi board with Web-App, and develop similar applications for Mobile App	
		CO4	Develop Project using Raspberry pi based controlled with Web Apps or Mobile Apps	
18EE2105	Electrical Circuit Theory	CO1	Understand the circuit elements and AC fundamentals for electrical networks	
		CO2	Apply Network theorems to Electrical networks (AC & DC)	
		CO3	Analyze the Two port networks, Resonance	

			& Transients
		CO4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction

PROFESSIONAL CORE COURSES

18EC1202	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
		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
18EC2103	ANALOG ELECTRONIC CIRCUIT DESIGN	CO1	Study of BJT's and Various application in Amplifiers
		CO2	Understand various types of FET's, IC Types and analyze FET as an Amplifier
		CO3	Understand the Linear & Non-linear application of Op-AMP and analyze active filters
		CO4	Analysis of different types of oscillators, filter and regulators.
		CO5	Design and Testing of Analog circuits for realistic applications
18EC2104	COMMUNICATION SIGNALS & SYSTEM DESIGN	CO1	To Interpret and analyze 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 analyzing the effects in the various communication systems.
		CO4	To develop the foundation of signal processing for communication and analyze with system design.
18EC2205	EMBEDDED CONTROLLERS	CO1	Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of 8086 microprocessor
		CO2	Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of 8051 Microcontroller
		CO3	Analyze the Interfacing of Peripherals to the 8051 microcontrollers through programming. Apply the knowledge of PIC, ATMEGA 32 &ARM Microcontrollers
		CO4	Apply the basic concepts of CORTEX STM- 32 microcontroller and Real Time OS
		CO5	Analyze the applications of programming with 8051 and 8086 on hardware / software. Analyze the applications of programming with Arduino
18EC2206	ANALOG AND DIGITAL	CO1	Apply time and frequency analysis techniques to Analog modulation systems.

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	COMMUNICATION	CO2	Analyze different digital modulation techniques.
		CO3	Analyze digital carrier, signaling techniques with baud rate considerations.
		CO4	Analyze different switching techniques and real time signaling systems.
		CO5	Design and analyze analog and digital communication circuits through project based learning using modern tools.
18EC2207	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	analyze the multi-rate signal processing concepts
		CO5	Develop signal processing algorithms in software and apply them to finding solutions to real time problems
18EC3109	DATA NETWORKS AND PROTOCOLS	CO1	Interpret the basic network structure, software and models, device and applications
		CO2	analyze the error detection and correction techniques in link layer protocols with cisco packet tracer
		CO3	Design and analyze different routing algorithms and network layer protocols
		CO4	Design and analyze transport and application layer protocols
		CO5	Design of different networking protocols using simulation
18EC2112	ELECTROMAGNETIC FIELDS & APPLICATIONS	CO1	Apply the principles of vector calculus and static fields to estimate the static electric fields and magnetic field due to different sources
		CO2	Develop the boundary conditions on E, H Fields and extend the concepts to obtain the governing laws of electromagnetic field that helps to perceive the wave propagation
		CO3	Analysis of different electromagnetic field applications
		CO4	Analyze different advanced electromagnetic field applications
18EC2213	STATISTICS, AI, ANN-Basic course	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.
18EC2222	INTRODUCTION TO AI, ANN TOOLS & APPLICATIONS	CO1	Describe the basics of Probability, statistics and 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	Develop and synthesize AI and ANN Models for real

			time applications.
FLEXI COURSES			
18EC2208	VLSI DESIGN	CO1	Apply the voltage biasing techniques to analyze MOS characteristics
		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
18EC4111	WIRELESS COMMUNICATIONS	CO1	Apply the wireless communication concepts to interpret cellular architecture
		CO2	Analysis of different fading mechanisms 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
18EC3016	RF SYSTEM DESIGN	CO1	Apply smith chart to analyze the impedance measurement for various passive RF devices.
		CO2	Design and analyze RF filters
		CO3	Design and analyze RF amplifiers and oscillators
		CO4	analyze the design considerations of different real-time applications
		CO5	Design and analyze different RF amplifiers, oscillators and other applications using HFSS
18EC3017	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.
18EC3018	ELECTRONICS INSTRUMENTS & AUTOMATION	CO1	Demonstrate the characteristics of Electronics instruments and their Measurements and apply them to compute measurements.
		CO2	Explore the fundamental 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 robotic systems with desired response.
		CO4	Analyze the industrial automation based applications

			and summarize their advantages in sustainable development.
		CO5	Synthesize various electronic instruments and control systems for automation.
18EC3019	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.
18EC3020	ELECTRICAL TECHNOLOGIES & SOLAR POWER SYSTEMS	CO1	Interpret the basics of electrical technologies on electrical circuits, motor and generators.
		CO2	Analyze the concepts of power generation, transmission, and distribution on commercial systems and modern distribution systems.
		CO3	Analyze 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
		CO5	Design and development of electrical circuits, power systems and analysis of solar photovoltaic systems
18EC3021	ADVANCE COURSE IN SOFT-	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

EMBEDDED CONTROLLERS, IOTS & POWER ELECTRONICS

18EC3051	Wireless sensor Networks & IOT Applications	CO1	Interpret the basics of WSN, challenges and applications
		CO2	Apply and demonstrate various WSN protocols using NS-2 simulator
		CO3	Analyze IoT reference architectural views and design issues of WSN
		CO4	Design and analyze IoT applications using simulation tool Tinker Cad
18EC3052	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.

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		CO4	Analyze the SPV arrays, configurations with AI and ML.
18EC3053	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	Analyze the Concept of smart grid sub system and circuits
		CO4	Analyze Smart grid to IOT applications with smart grid security, communication and power system
18EC3054	IOT Applications for Smart Cities	CO1	Interpret the basics of smart cities and IoT based solutions for smart cities
		CO2	Analyse the systems for smart cities with case studies.
		CO3	Analyse IoT applications for Smart cities in various domains like Oil & gas industry, retailing industry
		CO4	Demonstrate M2M communications, M2M and IoT value chains
18EC3055	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 & MICRO - ELECTRONICS

18EC3061	Low Power VLSI	CO1	Interpret the fundamental concepts of power dissipation in MOS structure
		CO2	Apply low power techniques at circuit level for CMOS circuits and Illustrate the probabilistic power analysis
		CO3	Apply low power techniques for various combinational circuits.
		CO4	Design and analysis of low power techniques for memories.
18EC3062	Algorithms for VLSI Design Automation	CO1	Apply the graph and partitioning algorithms on addressing Computational complexity
		CO2	Apply the floorplanning and placement algorithms and Analyse modelling of various Designs
		CO3	Apply the routing Algorithms for high-level transformation
		CO4	Interpret and analyze FPGA technologies and apply to various VLSI designs
18EC3063	ASIC and FPGA Chip Design	CO1	Design of combinational and sequential circuits using PLDs and state machines.
		CO2	Design of Full-custom & Semi Custom methodologies of different PLD architectures.
		CO3	Develop different PLD structures and its design process of CPLD and FPGA architectures
		CO4	Apply different physical process of PLDs
18EC3064	VLSI Sub-system Design and Design	CO1	Analyse the performance of various CMOS based Combinational logic circuits and PLDs with their

	for Testability		performance characteristics
		CO2	Design of various memories, memory technologies and their characteristics
		CO3	Apply & Illustrate the fault detection & recovery methods to achieve fault tolerant design of VLSI chips & fault detection in combinational circuits are described.
		CO4	Apply the test pattern generation for BIST, specific BIST architectures and ATPG
18EC3065	Semiconductor Memories & MEMS	CO1	Demonstrate the basics of non-volatile memories and its applications
		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
18EC3066	Analog & Digital IC Applications	CO1	Construct Large and small signal models of MOSFETs, considering device nonlinearity using Engineering Fundamentals.
		CO2	Design Analog Sub-systems using switched capacitor techniques
		CO3	Investigate the performance of digital system using metrics-Signal skew, clock skew and metastability
		CO4	Validate the designs of combination & Sequential logic circuits using CMOS logic
AUTOMATION & ROBOTICS			
18EC3071	Control Systems & Introduction to Robotics	CO1	Apply the concepts of control systems and analyze 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 kinematics to analyze the dynamic control in robotic design.
18EC3072	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.
18EC3073	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
18EC3074	Computer Vision & Applications	CO1	Examine the fundamental concepts related to multi-dimensional signal processing and describe their usefulness in computer vision applications.
		CO2	Inspect various image representation models and

			examine their characteristics.
		CO3	Analyze various motion estimation models in video data and criticize their performance.
		CO4	Illustrate various machine learning models for computer vision applications and test their performance.
18EC3075	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 paradigms.
		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.
18EC3076	Designing Automation Systems & Assistive Robotic Systems	CO1	Apply the 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	Synthesis of basic assistive robots and exploring the application of robotics for human assistance and show the parameters required for designing assistive technologies.

SIGNAL PROCESSING

18EC3081	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
18EC3082	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 analyzing images in frequency domain and evaluate their capabilities.
		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	Develop and modify various image processing algorithms.
18EC3083	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.

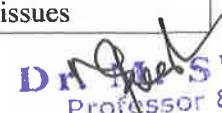|		CO3	Analyze the extracted features from biomedical images and categorize them with respect to usefulness in automation.
		CO4	Discover important existing real time biomedical image analysis tools and explain
			their design processes.
18EC3084	Statistical Signal Processing	CO1	Apply statistical signal 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
18EC3085	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.
18EC3086	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 estimator.
		CO4	Describe the importance of state estimation in various applications and report the process flow models.
18EC3087	Biomedical Signal Analysis	CO1	Describe various sources of bio signals 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.
COMMUNICATION & WIRELESS			
18EC3091	Information Theory & Coding	CO1	Analyze different statistical models for information theory and coding
		CO2	Analyze different coding methodologies for measurement of information
		CO3	Analysis of various error detection and correction techniques
		CO4	Analysis of various Error detection and correcting using state diagrams

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18EC3092	4G Wireless Technologies and Cellular Communication	CO1	Analysis of Spreading Sequences and Multi-user systems
		CO2	Analysis of Multi-carrier Communication Systems
		CO3	Analysis of Multi-user communications systems
		CO4	Interpret various Advanced cellular communications and allied topics
18EC3093	Satellite Communications	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
18EC3094	Optical Communication and Networks	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
18EC3095	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
DATA COMMUNICATION & NETWORKS			
18EC4051	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
18EC4052	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
		CO4	Apply NAT techniques and Analyse the quality of service for networks with SIP protocol
18EC4053	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 applications
		CO2	Analysis of radio access technologies for 5G
		CO3	Analysis of multi-hop and multi-carrier systems for 5G
		CO4	Interpret various IEEE standards
18EC4054	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

18EC4055	IP Multimedia Sub-System & Emerging Technologies (Cloud, IOT, NFV, SDN)	CO1	Apply PSTN fundamentals to analyze 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

RF, MICROWAVE & RADARS

18EC4061	Microwave Engineering	CO1	Analysis of different microware components and devices
		CO2	Apply S parameters and Analysis of different microware components
		CO3	Apply S parameters and Analysis of microwave filters and periodic structures
		CO4	Interpret the applications of microwave and mill metric wave circuits
18EC4062	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.
18EC4063	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
18EC4064	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.
18EC4065	Electronic Warfare, EMI & EMC	CO1	Understand the basic concept of Electronic Warfare
		CO2	Interpret 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

AI & ML

18EC4071	Machine Learning	CO1	Interpret fundamental concepts of machine learning and review their importance in applications.
		CO2	Describe clustering algorithms and test their capabilities across multiple datasets.
		CO3	Summarize classification models in ML and employ them to solve supervised learning problems.
		CO4	Analyze multiple domain-based machine learning algorithms and demonstrate their pipelines.
18EC4072	Data Sciences & Big-Data	CO1	Analyze various mathematical fundamentals associated with data analytics and provide statistical solutions.
		CO2	Describe big data architectures and illustrate their usefulness across multiple domains.

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		CO3	Apply big data streaming and analyze their performance across Hadoop platform.
		CO4	Analyze case studies in big data applications and report their performance.
18EC4073	Pattern Recognition	CO1	Analyze the fundamental concepts in pattern recognition and compare their performance.
		CO2	Interpret statistical pattern recognition models and test their usefulness qualitatively.
		CO3	Apply structural pattern recognition models and show their process flow in finding solutions through machine learning.
		CO4	Analyze existing applications in pattern recognition and describe their pipelines.
18EC4074	Block-Chain & Cyber Security	CO1	Categorize the various block chain concepts to provide solutions to multidomain applications
		CO2	Analyze the importance of cryptocurrency and to discover the importance and impact on fiat currency
		CO3	Identify the various security threats in cyber world and to find solution to prevent security threats
		CO4	Apply the concept of block chain technology and cyber security to address solutions for societal problems
18EC4075	Video Surveillance	CO1	Interpret fundamental concepts related to Video Surveillance and characterize their usage in video object feature extraction and object detection algorithms.
		CO2	Apply visual tracking and detection from video sequences and demonstrate the performance of the algorithms quantitatively.
		CO3	Analyze the human characterization in surveillance networks and test their performance in real time video processing applications.
		CO4	Summarize multiple video surveillance use cases and evaluate their usefulness in the automation of video surveillance applications.
BIO-MEDICAL INSTRUMENTATION			
18EC4081	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 demonstrate 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.
18EC4082	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

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			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.
18EC4083	Biological & Cyber-Physical Systems	CO1	Apply the functionality of basic instruments used in cyber-physical systems and report their characteristics across applications.
		CO2	Analyze application fields of cyber-physical systems and demonstrate the process flow maps used in them to extract sustainability.
		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.
18EC4084	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.
Skilling Courses			
18SC1106	Technical Skill - 1 (Coding)	CO1	Apply and Analyze solution to solve real world problems using algorithms and flowcharts
		CO2	Apply and analyze solutions for real world problems using control flow statements by sorting algorithms
		CO3	Apply and Analyze solutions and debug to solve real world problems using user defined functions by searching algorithms
		CO4	Apply and analyze solutions for real world problem and debugging using Stacks, Queues and Linked List.
18SC1207	Technical Skill - 2 (Coding)	CO1	Apply the concepts of basic programming to solve the basic problems, pattern based problems
		CO2	Build solutions for problems on Numbers and array based problems , functions, recursion
		CO3	Solve problems solutions for character/string based problems and pointers
		CO4	Build solutions to programs on Data structures concepts.
18TS401	SKILLING FOR ENGINEERS-1 (IT CODING/HARDWARE CODING)	CO1	Basic Building Block concepts of Programming related to Input-Output function, If-Else, Nested If-Else and Switch Case. And the problems related to it.
		CO2	Basic Building Block concepts of Programming related to For loop, while loop, break, Continue,Goto. And the problems related to it.

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		CO3	"Pointers"- Call by Value and Call by Reference, An Introduction to Pointers, Back to Function Calls. Problems related to Pointers.
		CO4	"Arrays, Strings": Basic Concepts and Problems related to Arrays 1D and 2D, Strings.
18TS402	SKILLING FOR ENGINEERS-2 (IT CODING/TECHNIC AL SKILLING)	CO1	Introduction to GSD and LabVIEW Environment such as Front Panel, Controls Palette, Controls and Indicators, Block Diagram Terminals, Functions Palette, Data Type, Boolean Operations, String Operations.
		CO2	Introduction to Loop Concept, Nested Loop, Feedback, Arrays, Cluster, Plotting Data using chart and Graph, Tunnel Concept, Introduction to parallelism, Local Variable, Global Variable, Property Nodes, Invoke Nodes using LabVIEW.
		CO3	Introduction to Case structures, Case Control using Enumerated data type, Introduction to Flat Sequence, Create New Sub VI, Input and Output Sub VI Connectors, Error handling and Debugging Techniques, Introduction to File I/O operations, Event Structure and operations, Design Technique, Introduction to Architecture, Synchronization and Communication using LabVIEW.
		CO4	MATLAB Introduction, Matlab Toolbox for Signal Processing, Matlab Toolbox for AI , Matlab Toolbox for ML, Introduction to Latex, Documentation concept with Latex, Paper writing with Latex
18TS403	SKILLING FOR ENGINEERS-3 (IT CODING/TECHNIC AL SKILLING)	CO1	Learning the Domain based tool and understanding the real time applications
		CO2	Explore the tool for basic operational applications
		CO3	Design and coding of Minor Projects (Real time applications)
		CO4	Applying the domain based tool for project developments which can be used as a product
18TS404	SKILLING FOR ENGINEERS-4 (IT CODING/TECHNIC AL SKILLING)	CO1	Learning the Domain based tool and understanding the real time applications
		CO2	Exploring the tool for basic operational applications
		CO3	Design and coding of Minor Projects (Real time applications)
		CO4	Applying the domain-based tool for project developments which can be used as a product
18TP3101	Technical Proficiency & Training -1	CO1	Learning the Domain based tool and understanding the real time applications
		CO2	Understanding the tool for basic operational applications
		CO3	Understanding the tool for Minor Projects (Real time applications)
		CO4	Applying the domain-based tool for project developments which can be used as a product
18TP3202	Technical Proficiency & Training -2	CO1	Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create file for schematic, create pyxis schematic, Design of a basic CMOS inverter using pyxis schematic, pre layout simulation.
		CO2	Learning the Domain based tool and understanding the real time applications
		CO3	Understanding the tool for basic operational applications
		CO4	Understanding the tool for Minor Projects (Real time applications)

TERM PAPER & PROJECT			
18IE2246	INDUSTRIAL TRAINING		INDUSTRIAL TRAINING
18IE3247	TERM PAPER	CO5	The term paper must be taken up by the VI Semester students. It is based on independent research in one of the areas opted by the student. In a term paper, a student should demonstrate his/her ability in finding out the relevant sources, selection, an illustration of logic, and in organizing the information on the topic, gathering the data, processing, analyzing, and summarizing.
18IE4048	PROJECT (PART I)	CO5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab- oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day- to-day productivity and punctuality of the student.
18IE4049	PROJECT (PART II)	CO5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab- oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day- to-day productivity and punctuality of the student.
18IE4050	PRACTICE SCHOOL	CO5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab- oriented activities. As a part of education, this
			project course follows a method of learning and therefore, the student's actual day-today task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day- to-day productivity and punctuality of the student.
18IE4051	Summer INTERNSHIP	CO5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab- oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-today task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day- to-day productivity and punctuality of the student.
18PR3080	MID-GRADE CAPSTONE	CO5	The course is specially designed to provide an opportunity to the students for development of their

	PROJECT		academic skills and logical thinking through open ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day- to-day productivity and punctuality of the student.

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