Koneru Lakshmaiah Education Foundation
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Department of Electronics and Communication Engineering
Program: B.Tech -ECE
Academic Year : 2019-20

Course Code	Course Title	CO No.	Description of the Course Outcome
HUMANITIES & SOCIAL SCIENCES			
19UC1101	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.
19UC1202	ENGLISH PROFICIENCY	CO1	Apply the concepts of accurate English while writing and become equally at ease in using good vocabulary and language skills.
		CO2	Understand the importance of pronunciation and apply the same day to day conversation.
		CO3	Apply the concepts of ratios, percentages, averages and analyze the given information on the basis of comparative analysis of the data in the

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			form of tabulation, bar graphs, pie charts, line graphs.
		CO4	Apply the basic functionality of clocks and calendars to find the solutions for the problems. Analyze the given symbols to understand the hidden meaning of the given expression and find the solutions. Analyze the possible arrangements in linear & circular order.
19UC2103	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 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.
19UC2204	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

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			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 & Alligations, 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.
19UC3105	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.
19UC3206	Campus to Corporate	CO1	Analyze basic concepts of critical and analytical reasoning skills apply strategies analyze issues, arguments and some aspect of corporate communication.

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		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.
19UC0007	*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
19UC0008	*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
19UC0009	*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.
19UC0010	*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.

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		CO3	Analyze the profession and his role in this existence.
BASIC SCIENCES			
19MT1101	MATHEMATICS FOR COMPUTING	CO1	Understand the basic Structures, relations and permutations & combinations, probability
		CO2	Model and solve the relevant physical problems mathematically as a system of linear equations.
		CO3	Apply the rules of Propositional logic to establish valid results of mathematical arguments, Induction and solve recurrence relations.
		CO4	Understand the graphs and analyze different problems associated with computer, logic design.
		CO5	Describe the Aptitude & Reasoning skills
19MT2102	MATHEMATICS FOR ENGINEERS	CO1	Apply differential and integral calculus to find maxima & minima of functions and evaluate the integrals
		CO2	Model and solve the relevant phenomena as a differential equation .
		CO3	Demonstrate Fourier series and Analytic functions
		CO4	Describe probability , Random Variables and Algebraic structures
19BT1001	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
19PH1008	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

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19 PH1004	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
		CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects.
19PH2101	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
19CY1101	ENGINEERING CHEMISTRY	CO1	Demonstrate different types of semiconducting materials
		CO2	llustrate photophysical 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

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			experimental skills
19CY1002	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 bioelectrodes 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	Analyse the properties of the samples using analytical instruments which are useful for clinical analysis in health care, drugs and pharmaceutical laboratories.
19CY1004	Organic Electronics	CO1	Demonstrate different types of semiconducting materials
		CO2	Illustrate photophysical 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			
19SC1101	PROBLEM SOLVING AND COMPUTER PROGRAMMING	CO1	Illustrate how problems are solved using computers and programming.
		CO2	Illustrate and use Control Flow Statements in C.
		CO3	Interpret & Illustrate user defined C functions and different operations on list of data.
		CO4	Implement Linear Data Structures and compare them.
		CO5	Apply the knowledge obtained by the course to solve real world problems.
19SC1202	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

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			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.
19ME1103	DESIGN TOOLS WORKSHOP - I	CO1	Practice design thinking by developing artistic skills
		CO2	Visualize and practice innovative design by final drafting using photogrammetric and model the design using prototyping technique
		CO3	Apply the concept of AI & Data analytics & finalize the requirements to design his idea
		CO4	Draft a report of his project from the initial stage & make a report which include scope, time and cost management of his project
19SC1209	DESIGN TOOLS WORKSHOP - II	CO1	Practice the design ideology by artistic skill
		CO2	Visualize the design ideology by using VR technology
		CO3	Visualize the design ideology by incorporating VR technique
		CO4	Visualize and present his design idea by applying AR technique
19SC1106	TECHNICAL SKILLS-1(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.
19SC1203	OBJECT ORIENTED PROGRAMMING PM	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

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			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.
19EC1101	DIGITAL LOGIC & PROCESSORS	CO1	Understand numerical and character representations in digital logic, number system, data codes and the corresponding 8design of arithmetic circuitry. Understanding Logic gates, Logic theorems, Boolean algebra and SOP/POS expressions.
		CO2	Combinational systems design using standard gates and minimization methods
		CO3	Sequential systems: Design of counters using flip flops.
		CO4	Understanding PLA's, PAL's, FPGA's and processors
		CO5	Analyzing and realization of Boolean functions, half adder, encoders, decoders, flip flops and counters.
19EC1213	BASIC ELECTONICS AND CIRCUITS	CO1	Understand the basic electronic components.
		CO2	Understanding of junction diode, I-V characteristics and applications of diodes.
		CO3	Understanding the design and working of power supply and regulators using zener diodes.
		CO4	Understand the working of BJT and study of data sheets, analog and digital IC's.
19EC2111	ELECTRONIC WORKSHOP-I I (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

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			techniques and also design an embedded system using raspberry Pi to demonstrate for social problems.
19EC2214	ELECTRONIC WORKSHOP-III (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.
19EC2112	IT WORKSHOP-I (HTML,XML,WEB DESIGN)	CO1	Understand the HTML coding
		CO2	Understand the XML
		CO3	Learning of web designing and hosting
		CO4	Hands on app development using Android studio for mobile applications.
20UC1101	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	Plan the necessary activities towards solving the problem through ideation and prototyping
		CO4	evaluate the solution and refine them based on the customer feedback
PROFESSIONAL CORE COURSES			
19EC1202	COMPUTER	CO1	Apply the concepts of logical modules in

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	ORGANIZATION & ARCHITECTURE		the design of CPU,control unit and registers
		CO2	Analy the operations of Main memory,cache memory and virtual memory
		CO3	Infer the different I/o subsystems and various I/O transfer techniques
		CO4	Analyse the design issues of RISC and CISC CPUs and the pipeline architectures.
19EC2103	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
19EC2104	COMMUNICATION 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.
19EC2105	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.

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19EC2106	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 modesand data transfer instructions of 8051 Microcontroller
		CO3	Analyse the Interfacing of Peripherals to the 8051 microcontrollers through programming. Apply the knowledge ofPIC, 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
19EC2207	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
18EC2208	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
19EC2209	STATISTICS, AI, ANN-Basic course	CO1	Apply the concepts of probability and distributions to analyze engineering

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			problems.
		CO2	Discover the relationship between statistics and machine learning and illustarte 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.
19EC2210	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 netowrk layer protocols
		CO4	Design and analyse transport and application layer protocols
		CO5	Design of different netowrking protocols using simualtion
19EC2223	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 timeapplications.
FLEXI COURSES			
19EC3015	VLSI DESIGN	CO1	Apply basic principles of mathematics and sciences to conceptualize MOS device operation and fabrication process.
		CO2	Analyse MOS device characteristics and device scaling process.
		CO3	Design/Construct stick diagrams and layouts for CMOS digital systems.
		CO4	Evaluate CMOS based integrated circuit performance using fault models.
		CO5	Use modern EDA tools to synthesize CMOS digital systems.
18EC4111	WIRELESS COMMUNICATIONS	CO1	Apply the wireless communciation concepts to interpret cellular architecture
		CO2	Analysis of different fadding mechanisims in mobile communications

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		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
19EC3017	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
		CO4	Analyse the design considerations of different real-time applications
		CO5	Design and analyze different RF amplifers, oscillators and other applications using HFSS
19EC3018	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.
19EC3019	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.

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		CO4	Analyze the industrial automation based applications and summarize their advantages in sustinable developement.
		CO5	Synthesize various electronic instruments and control systems for automation.
19EC3020	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.
19EC3021	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
		CO5	Design and development of electrical circuits, power systems and analysis of solar photovoltaic systems
19EC3022	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.

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LIST OF SKILLING COURSES			
19TS4001	SKILLING FOR ENGINEERS-1	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	Introduction to Data Acquisition, Introduction to NI myDAQ; Study of simulate signal express VI and verifying Nyquist theorem; Generating waveform signals; Acquiring generated signal; Build and develop Temperature monitoring system
19TS4002	SKILLING FOR ENGINEERS-2	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

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			Debugging Techniques
		CO4	Introduction to File I/O operations, Event Structure and operations, Design Technique, Introduction to Architecture, Synchronization and Communication using LabVIEW.
19TS4003	SKILLING FOR ENGINEERS-3	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.
19TS4004	SKILLING FOR ENGINEERS-4		
19TS4005	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.
19TS4006	TECHNICAL PROFICIENCY & TRAINING-2		
LIST OF PROFESSIONAL ELECTIVES			
IORs & Smart Cities			
19EC3051	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	Analyse IoT reference architectural views and design issues of WSN
		CO4	Design and analyse IoT applications using simulation tool TinkerCad
19EC3052	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

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			optimization techniques.
		CO4	Analyse the SPV arrays, configurations with AI and ML.
19EC3053	Electronic Systems for Renewable Energy & Smart Grid	CO1	Apply the concept of Renewable Energy with solar power and electronic power converters.
		CO2	Analyse 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
19EC3054	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	Demonstarte M2M communications, M2M and IoT value chains
19EC3055	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	Demonstrate the basics of non-volatile memories with proper examples
19EC3056	Cloud Architecture in IoT	CO1	Interpret the sensing and moving data across the network to stored in the clouds and extract data from the cloud.
		CO2	Apply the fundamental cloud computing protocols on data storage into cloud and retrieval of the same from the clouds
		CO3	Interpret the different application for storing the sensed data in to clouds
		CO4	Apply the IoT device into cloud and implement the communication between IoT device and cloud (Thingspeak, Azure and AWS)
VLSI & MICRO - ELECTRONICS			
19EC3061	Low Power VLSI	CO1	Interpret the fundamental concepts of power dissipation in MOS structure

		CO2	Ability to Illustrate the 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.
19EC3062	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 analyse FPGA technologies and apply to various VLSI designs
19EC3063	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 proces of CPLD and FPGA architectures
		CO4	Apply different physical process of PLDs
19EC3064	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
19EC3065	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	Apply the memory fault models and testing process for memories
19EC3066	Analog & Digital IC Applications	CO1	Understand large and small signal models of MOSFETs through device nonlinearity principles and Engineering Fundamentals.
		CO2	Apply the small signal models for Analog Sub-systems using switched capacitor techniques

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		CO3	Apply the metrics-Signal skew, clock skew and metastability for digital system for calculating the delay of the digital systems
		CO4	Design combination & Sequential logic circuits using CMOS logic
Robotics & Automation			
19EC3071	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.
19EC3072	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 fundemental principles of automotive electronic control systems
		CO4	Illustrate the case studies on autonomous vehicles and automotive electronics.
19EC3073	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
19EC3074	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 critisize their performance.
		CO4	Illustrate various machine learning models for computer vision applications and test their perfromance.

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19EC3075	Human Machine Interface & Brain Machine Interface	CO1	Interpret the Basic Idea of Human Machine Interactions, and its Goals
		CO2	Develop a human–computer interaction (HCI) models, styles, and various historic HCI paradigms
		CO3	Apply the cconcepts of Brain Machine Interactions, and brain waves
		CO4	Apply an interactive design process and universal design principles to designing HCI/BMI systems
19EC3076	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			
19EC3081	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
19EC3082	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.
		CO3	Develop restoration, segmentation and filtering algorithms on degraded images and list their efficiencies.
		CO4	Develop compression models and examine their performance for data

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			transmission.
		CO5	Develope and modify various image processing algorithms.
19EC3083	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.
19EC4084	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
19EC4085	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.
19EC4086	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

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			a signal estimatior.
		CO4	Describe the importance of state estimation in various applications and report the process flow models.
19EC4087	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.
Wireless Communication			
19EC3091	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
19EC3092	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 communiction systems
		CO4	Interpret various Advanced cellular communications and allied topics
19EC3093	Satellite Communications	CO1	Apply basic concepts of communications to satellite communciation
		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
19EC3094	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

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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			
19EC4051	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
19EC4052	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
19EC4053	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
19EC4054	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
19EC4055	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

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		CO3	Analyse IMS-PSTN and IMS services for GSM, Web-Msg, voice, VoLTE erc
		CO4	Interpret various Emerging Tech. of IMS
RF, MICROWAVE & RADAR			
19EC4061	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
19EC4062	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.
19EC4063	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
19EC4064	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.
19EC4065	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 Computing			
19EC4071	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

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			learning problems.
		CO4	Analyze multiple domain-based machine learning algorithms and demonstrate their pipelines.
19EC4072	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.
		CO3	Apply big data streaming and analyze their performance across Hadoop platform.
		CO4	Analyze case studies in big data applications and report their performance.
19EC4073	Pattern Recognition	CO1	Analyze the fundamental concepts in pattern recognition and compare their performance.
		CO2	Interpret statistical pattern recognition models and test their usefulness qulitatively.
		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.
19EC4074	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	Indentify 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 socital problems
19EC4075	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.

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		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.
Instrumentation & Bio-Medical Electronics			
19EC4081	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	Design case studies of fundamental concepts in avionics and report design functionalities.
19EC4082	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.
19EC4083	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 sustainablility.
		CO3	Discover the usefulness of biological models in formulating digital systems and examine their impact on designing learning algorithms.
		CO4	Apply the knowledge of the application

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			pipelines and report the design and performacne parameters.
19EC4084	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.
19EC4085	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 fundemental principles of automotive electronic control systems
		CO4	Illustrate the case studies on autonomous vehicles and automotive electronics.
19EC4086	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.

Academic Professor I/C

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