KLEF Department of Electrical and Electronics Engineering Y20 Admitted batch CO-PO mapping			
COURSE CODE	**COURSE TITLE**	**CO NO**	**Description of the Course Outcome**
20UC1101	INTEGRATED PROFESSIONAL ENGLISH	CO1	Understand the concepts of grammar to improve communication, reading, and writing skills
		CO2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context. Demonstrate ability to face formal situations / interactions.
		CO3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate rhetorical devices
		CO4	Apply the concepts of writing to draft corporate letters, emails, and memos
20UC1202	ENGLISH PROFICIENCY	CO1	Demonstrating different interpersonal skills for employability
		CO2	Distinguishing business essential skills
		CO3	Classifying social media and corporate communication skills
		CO4	Applying analytical thinking skills
20UC2103	PROFESSIONAL COMMUNICATION SKILLS	CO1	Developing critical and analytical reading skills
		CO2	Discovering different interpersonal skills to develop people skills
		CO3	To enhance the problem-solving skills of the students through the concepts of Simple Equations, Ratio, Proportion &Variation, Percentages, Profit & Loss, Averages, Allegations, Simple & Compound Interest.
		CO4	Apply diagrammatic representation of the given data to find the possible outcomes in the topics of Deductions, Cubes, Venn Diagrams and Arrangements
20UC2204	CORPORATE COMMUNICATION SKILLS	CO1	To distinguish product and process and quote them in speaking and writing activities
		CO2	To apply interpersonal skills
		CO3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their problem solving abilities which in turn improve their programming skills.
		CO4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding
20UC3005	APTITUDE BUILDER	CO1	To discuss and interpret English language skills necessary for placements
		CO2	To demonstrate skills to get selected in interviews and retain job
		CO3	To enhance the problem-solving skills of the students through the concepts of Mensuration, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation, Data Sufficiency which will enable them to improve their problem-solving abilities which in turn improve their programming skills.
		CO4	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.
20UC0007	INDIAN HERITAGE AND	CO1	To familiarize with various aspects of the culture and heritage of India through ages.

		CO2	To acquaint with the contributions of Indians in the areas of languages and literature, religion and philosophy
		CO3	To understand the Social structure and the spread of Indian culture abroad
		CO4	To know the development of Science and Technology in India through ages and to appreciate the contributions of some of the great Indian scientists
20UC0008	INDIAN CONSTITUTION	CO1	To understand Constitutional development after Independence
		CO2	To learn the fundamental features of the Indian Constitution
		CO3	To get a brief idea of the powers and functions of Union and State Governments
		CO4	To understand the basics of working of Indian Judiciary and the Election Commission
20UC0009	ECOLOGY AND 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
20UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS	CO1	Understand and identify the basic aspiration of human beings
		CO2	Envisage the roadmap to fulfill the basic aspiration of human beings.
		CO3	Analyze the profession and his role in this existence.
20UC0011	ENTREPRENEURSHIP	CO1	Analyze the business environment in order to identify business opportunities,
		CO2	Identify the elements of success of entrepreneurial ventures
		CO3	Consider the legal and financial conditions for starting a business venture
		CO4	Evaluate the effectiveness of different entrepreneurial strategies
20MT1101	MATHEMATICS FOR COMPUTING	CO1	Model a system of equations for real world applications in engineering, physical and biological sciences, computer science, finance, economics and solve them through matrix algebra
		CO2	Model basic and computational techniques on discrete structures like relations, orders, functions & FSM, Lattices, and propositional &predicate logic
		CO3	Model real world structures and their related applications using advanced discrete structures like graphs and trees.
		CO4	Model the given Statistical data for real world applications in Engineering science, Economics and Management.
		CO5	Demonstrate the Aptitude and Reasoning skills (Tests in skilling hours)
20SC1102	INTRODUCTION TO DESIGN	CO1	Be able to understand elements and principles of design
		CO2	Able to grasp stage model of action cycle
		CO3	Be able to understand design laws and their importance in design field
		CO4	To comprehend various rules of composition of design
		CO5	To gain hands-on experience of fundamentals of design

19MT2102	MATHEMATICS FOR ENGINEERS	CO1	Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and solve the differential equations.
		CO2	Demonstrate the Fourier series and Laplace transforms.
		CO3	Describe probability, Random Variables
		CO4	Explain complex variables, analytic functions and introduction to stochastic process and Algebraic structures.
20EE2104	Mathematical Transforms for Signal Processing	CO1	Understand basic concepts related to Signals and Systems
		CO2	Apply Fourier series and transforms to various periodic and aperiodic waveforms
		CO3	Apply Laplace transforms and its properties to various signals
		CO4	Apply Z transforms and its properties to various signals
20SC1203	USER CENTRIC DESIGN TECHNIQUES	CO1	Understand the different roles and responsibilities in phases of User centered Design
		CO2	Identify user pain points and opportunity areas through empathy and collaborative design
		CO3	To be able to design a better User Experience using UCD and 6D process
20SC2104	DESIGN THINKING AND INNOVATION	CO1	Understand the basics of design thinking and its implications in product or service development
		CO2	Understand and Analyze 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
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
20SC1101	COMPUTATIONAL THINKING FOR DESIGN	CO1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm.
		CO2	Translate computational thinking into Logic Design for Solving real world problems.
		CO3	Apply and Analyse CRUD operations on Basic Data Structures using Asymptotic Notations.
		CO4	Apply and Analyse CRUD operations on Linear Data Structures using Asymptotic Notations.
		CO5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems.
20ME1103	DESIGN TOOLS WORKSHOP -I	CO1	Practice design thinking by developing artistic skills, Visualize and complete his/her innovative design by final drafting using 3D modeling
		CO2	Understand the concept of web page, web browser, web server, and able to create Static webpages

		CO3	Understand the concept of report writing using a markup language Latex
		CO4	Understand the concept of data visualization and creating data visualization dashboards, Understand the basic concept of VR/AR.
20SC1202	DATA STRUCTURES	CO1	Apply measures of efficiency to algorithms and Compare various linear data structures like Stack ADT, Queue ADT, Linked lists.
		CO2	Analyze and compare linear data structures and analyze different searching and hashing techniques
		CO3	Analyze and compare various non – linear data structures like Trees and Graphs
		CO4	Analyze and compare various sorting algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in a particular context.
		CO5	Execute lab experiments and develop a small project along with his/her team members.
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
19SC1203	Object Oriented Programming	CO1	Understand Basic Concepts of OOP, introduction to classes and objects through Java Language and apply.
		CO2	Understand the concepts of constructors, Overloading, parameter passing, access control, Inheritance and apply
		CO3	Understand Packages, Interfaces, and Exception Handling and apply.
		CO4	Understand I/O Streams & apply and understand Basic Concepts of Multi – Threading
19EE2101	ELECTRICAL CIRCUITS	CO1	Understand two port network parameters and their relations
		CO2	Analyze the transient behaviour of DC / AC circuits
		CO3	Understand the network topology and apply three phase circuit balanced and unbalanced circuits
		CO4	Understand magnetic circuit behaviour in series and parallel circuits
19PH1006	Materials & Measurements (Science Elective-1)	CO1	Understands structure of crystalline solids and appreciates structure property relationship in crystals.
		CO2	Understands the role of electronic energy band structures of solids in governing various electrical properties of materials.
		CO3	Apply the concepts of spin and orbital motion of electrons in determining magnetic properties of materials,the role in classifications & materials used for MEMS and power electronics.
		CO4	Apply the Basic fundamentals of a measurement system to estimate voltage, current, power, energy etc.
		CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects.
19CY1101	Engineering Chemistry (Scien	CO1	Predict potential complications from combining various chemicals or metals in an engineering setting

		CO2	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena
		CO3	Examine water quality and select appropriate purification technique for intended problem
		CO4	Explain the role of chemical kinetics in the formation and destruction of ozone in the atmosphere and predict the connection between molecular behavior and observable physical properties.
		CO5	An ability to analyze and generate experimental skills
20EC1101	Digital Logic & Processors	CO1	Describe the concepts of number systems wit h codes and logic gates usage in digital circuit design and identify the logical expressions in different forms and their minimization techniques for logical circuit optimization. Code conversions and digital IC's realization with respect to data sheets
		CO2	Employ combinational logic crcuits with minimization techniques and logical verification through hardware description language
		CO3	Substantiation of sequential logic circuits and logical verification through hardware description language
		CO4	Implementation of digital circuits using PAL, PLA and FPGA. Discriminate the operations of ALU and execution of microinstructions.
		CO5	Analyse the digital IC logic for combinational and sequential circuits implementation
19EC1202	Computer Organization & Architecture	CO1	Understand the functionality and design the CPU functional units - control unit, registers, the arithmetic and logic unit, the instruction execution unit, and the interconnections among these components.
		CO2	Understand, analyze and design main, cache and virtual memory organizations.
		CO3	Understand, analyze and design different types of I/O transfer techniques.
		CO4	Understand the design issues of RISC and CISC CPUs and the design issues of pipeline architectures.
20EE1201	Basic Electrical and Electronic Circuits	CO1	Understand the passive circuit elements and it combinations performance in DC circuits using mesh, nodal and theorems.
		CO2	Understand the fundamentals of AC circuits and apply concept of resonance to series and parallel circuits.
		CO3	Understand the VI Characteristics of active circuit elements.
		CO4	Applications of semiconductor devices
		CO5	Test and analyse the electrical and electronics circuits for DC and AC
19EE2205	Sensors & IOT	CO1	Understand the basics of Sensors and Actuators
		CO2	Understand the Internet of things architecture and applications
		CO3	Understand the Internet of things communication and protocols
		CO4	Apply the features of IOT using physical devices & endpoints
		CO5	Experiments Related to Sensors and IoT using TINKERCAD online platform and Embedded Hardware

19EC2103	Analog Electronics 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
19EC2106	Embedded Controllers	CO1	Understand the architecture and programming concepts of 8086 Microprocessor
		CO2	Apply the Programming concepts of 8051 Microcontroller
		CO3	Analyse the Interfacing of Peripherals to the 8051 microcontrollers through programming. Understand the basic architectures of PIC and ARM 7 microcontrollers
		CO4	Understand the basic concepts of CORTEX STM-32 microcontroller and RTOS
		CO5	Analyze the applications of programming with 8051 and 8086 on hardware / software. Analyze the applications of programming with Arduino
19EE2102	Electrical Power Engineering	CO1	Understand working of various generating stations and economical aspects of generation
		CO2	Understand the parameters of overhead transmission lines and underground cables
		CO3	Analyze the performance of overhead transmission lines and AC/DC distribution.
		CO4	Understand Mechanical Sag, corona, Insulators and substation layouts.
19EE2103	Electrical Machines	CO1	Understand the basic principles of electro mechanical energy conversion.
		CO2	Understand the operating characteristics of various types of DC machines
		CO3	Analyze the performance of DC machines.
		CO4	Analyze the performance of Transformers.
		CO5	Test the performance of DC machines and transformers.
19EE2201	Industrial Applications of Electrical Machines	CO1	Understand the concepts of the 3-phase induction motor.
		CO2	Analyze the performance of 3-phase alternator.
		CO3	Analyze the performance of 3-phase synchronous motor
		CO4	Understand the concepts of 1-phase & special machines.
		CO5	Test the performance of AC Rotating Machines
19EE2202	Power Electronics	CO1	Understand the differences between signal level and power level devices.
		CO2	Analyse the operation and performance of DC-DC Converters
		CO3	Analyse the operation and performance of voltage source inverters
		CO4	Understand the operation of phase controlled converters
		CO5	Demonstrate and test basic power electronic converters by hardware realization and MATLAB software.

19EE2203	Computer Applications in Power Systems	CO1	Apply the network matrices for solution of power flow problems
		CO2	Apply the reactance diagrams for symmetrical short circuit faults in a power system
		CO3	Analyze unsymmetrical faults in a power system using Symmetrical components
		CO4	Understand various aspects of power system stability
20EE2204	Control Systems	CO1	Understand the basics of Control system components and its modelling.
		CO2	Analyse the control systems under time domain and stability analysis.
		CO3	Analyze the control systems under frequency domain analysis.
		CO4	Analyze the state space model equations and Understand the control though PLC
		CO5	Test the operation of control systems using software & prototype models
20EE3211	INDUSTRIAL COMMUNICATION PROTOCALS & CYBER SECURITY	CO1	Understand the various Industrial Data Communication networks
		CO2	Understand the industrial protocols and standards.
		CO3	Apply the knowledge of cyber-security in industrial and various automation domains.
		CO4	Understand the hacking concepts and counter attacking methods in automation.
19EE3112	IOT FOR INDUSTRIAL AUTOMATION	CO1	Understand the IOT terminology, technology
		CO2	Apply the IOT elements to industrial automation
		CO3	Understand the concept of M2M (machine to machine) with necessary protocols
		CO4	Apply M2M for industrial automation
20EE3113	INDUSTRIAL DRIVES AND CONTROL	CO1	Understand electric drive system components and dynamics of a drive system.
		CO2	Develop controllers for DC drive systems.
		CO3	Develop controllers for AC drive systems.
		CO4	Apply special machine drives for precise industrial processes.
19EE3111	INDUSTRIAL AUTOMATION AND ROBOTICS	CO1	Apply the principles of automation to industrial needs
		CO2	Analyze control structure for process automation
		CO3	Apply the principles of robotic control for industrail needs
		CO4	Analyze the copntrol of robotic process conntrol
20EE3213	SMART SENSORS AND SENSOR NETWORKING	CO1	Understand the basics of smart sensors and micromachining
		CO2	Apply the sensor communication protocols
		CO3	Apply the packaging, testing and reliability of smart sensors:
		CO4	Understand the wireless sensor networks
19EE3121	SOLAR PV AND THERMAL TECHNOLOGIES	CO1	Understanding the need of Solar PV and Solar Thermal systems
		CO2	Understanding the applications of solar thermal energy systems
		CO3	Understand the design aspects of Solar PV system
		CO4	Understand the operational issues of grid connected and isolated solar PV system

19EE3122	WIND AND MICRO ENERGY SOURCES	CO1	Understand the concepts of wind energy conversion and measurement system.
		CO2	Apply the concepts of wind energy system to electric power grid.
		CO3	Understand the concepts ofgeothermal energy systems.
		CO4	Understand the concepts of tidal, ocean and bio-mass energy systems.
19EE3132	DISTRIBUTED ENERGY RESOURCES AND SMART GRIDS	CO1	Understand different types of distributed energy resources
		CO2	Apply the principles for integrating DERs to grid
		CO3	Understand smart grid objectives and its activities in India
		CO4	Understand and monitor various applications in smart grid with its smart infrastructure
20EE3222	ENERGY MANAGEMENT SYSTEMS & SCADA	CO1	Understand SCADA and its architecture.
		CO2	Understand the application of SCADA in various utilities.
		CO3	Apply the knowledge of energy management system in various real time applications on transmission side.
		CO4	Apply the knowledge of Demand Side Management in analyzing various real time applications on distribution side.
20EE3232	SMART GRID COMMUNICATION AND CYBERSECURITY	CO1	Understand the communication technologies for smart grid
		CO2	Apply the knowledge of information security in smart grids.
		CO3	Understand the Interoperability and Standards.
		CO4	Understand the hacking techniques and cyber-security in smart grid.
19EE3131	DISTRIBUTION SYSTEM PRACTICES	CO1	Understand the computation of power distribution system losses
		CO2	Understand the substation erection and commissioning as per the standards
		CO3	Analyze the various protective devices of distribution system
		CO4	Understand the testing of distribution system equipment
19EE3231	SMART GRID COMMUNICATION AND CYBER SECURITY	CO1	Understand the communication technology and standards in smart grid
		CO2	Apply the knowledge of information security in smart grids.
		CO3	Understand the Interoperability and Standards.
		CO4	Understand the hacking techniques and cyber-security in smart grid.
20EE3233	INTERNET OF THINGS AND SMART GRID ANALYTICS	CO1	Understand network protocols and standards
		CO2	Apply IoT in smart
		CO3	Understand various applications of IoT to to Smart Grids
		CO4	Apply Big Data Analytics in smart grid
19EE3142	BATTERY MODELLING FOR ELECTRIC VEHICLES	CO1	Understand the key components of Battery management systems
		CO2	Understand the key functions of Battery management systems
		CO3	Analyze the static battery models
		CO4	Analyze the dynamic battery models
20EE3241	CHARGING STATION FOR	CO1	Analyze Power electronic converters for electric vehicle charging applications

		CO2	Develop control algorithms for various electric vehicle charging modes
		CO3	Analyze control of Fast charging station
		CO4	Demonstrate installation of charging station
19EE3142	BATTERY STATE ESTIMATION ALGORITHMS FOR ELECTRIC VEHICLE	CO1	Understand the specifications and Li-ion chemistry
		CO2	Understand the key functions of Battery management systems
		CO3	Develop Enhanced Self Correcting (ESC) Model of battery
		CO4	Develop Algorithms for SOC estimation of battery
19EE3242	AI AND IOT FOR ELECTRIC VEHICLE	CO1	Demonstrate IoT devices and tools
		CO2	Operate the cloud system Environment
		CO3	Applying ML Techniques for Electric Vehicles
		CO4	Applying AI techniques for EV Applications
20EE3243	COMMUNICATION PROTOCOLS & TESTING OF ELECTRIC VEHICLE	CO1	Understand the communication protocols used in Electric Vehicles
		CO2	Apply the communication protocols for fault diagnostics of Electric Vehicle
		CO3	Analyze the intricacies of integrating HV and LV components of vehicle
		CO4	Demonstrate system engineering/system validation
19EE3101	AI TECHNIQUES IN ELECTRICAL ENGINEERING	CO1	Understand the neural network models, different architectures with different learning types and various algorithms for ANN to solve the load forecasting problems in Power systems
		CO2	Apply ANN paradigms in Electrical Engineering
		CO3	Apply the fuzzy logic concept, fuzzy sets, with suitable membership function with proper de-fuzzification methods Electrical Engineering
		CO4	Apply the different cross over methods and their elitism, convergence of algorithm Electrical Engineering
		CO5	Analyze the experiments using ANN
20EE3105	UTILISATION OF ELECTRICAL ENERGY	CO1	Identify the motor ratings for different applications
		CO2	Understand the concepts of electric heating & welding.
		CO3	Compare various illumination methods
		CO4	Apply electrical traction to different services
20EE3202	RESTRUCTERED POWER SYSTEMS	CO1	Understand the concept of deregulated market structures and reforms in Indian Power Sector
		CO2	Apply different techniques for finding available transfer capacity for congestion management
		CO3	Analyze transmission pricing methods and effect of congestion on LMPs
		CO4	Understand ancillary services and system security in deregulation
OEEE0014	Energy Estimation & Audit	CO1	Understand the present power scenario in India and need for energy estimation and Audit.
		CO2	Understand the operation of Induction motors and various energy conservation opportunities
		CO3	Understand the basics of transformers, cables and their energy conservation opportunities.

		CO4	Understand Lighting systems, pumping systems and their energy conservation opportunities.
OEEE0013	Renewable Energy Resources	CO1	Understand and analyze the solar thermal applications and solar photovoltaic cells
		CO2	Analyze the performance of wind and tidal, wave and Ocean thermal energy conversion systems
		CO3	Understand and analyze the operation of geothermal and bio energy conversion
		CO4	Understand and analyze the Biogas digesters and bio power plants
OECE0003	SOLID AND HAZARDOUS WASTE MANAGEMENT	CO1	Understand the importance types, sources and disposal methods of Solid waste.
		CO2	Summarize the importance of conversion and recycling of waste.
		CO3	Associate about types, Sources of Hazardous waste.
		CO4	Discuss the disposal and treatment methods of Hazardous waste.
20TS3101E	Technical Proficiency - 1 / Entrepreneurial Incubation	CO1	Implement Python Operators, Conditional statements, Collection Data Types and Functions
		CO2	Implementing Array through NumPy, Plotting, Visualization through matplotlib and Numerical Methods
		CO3	Implementing OOPS through Python, Data Structures through OOPS, Sci Py, Scikit- Learn, Pandas Libraries
		CO4	Analyse real world applications in Energy management, Electric drives, smart grid and automation using machine learning algorithms with Python
20TS3202E	Technical Proficiency - 2 / Technopreneurship	CO1	Develop schematic and panel drawings for electrical control systems using AutoCAD Electrical.
		CO2	Analyze various power system scenarios using modelling and analysis software.
		CO3	Apply Sensor Selection and integration to Real-Time IoT Applications using Raspberry Pi.
		CO4	Apply ADC, SPI, I^2C, UART, and PWM protocols for peripheral communication. Build electronic solutions with Raspberry Pi Pico microcontroller and use cloud for IoT data.