



# Koneru Lakshmaiah Education Foundation

(Category - 1, Deemed to be University established under Section 3 of the UGC Act, 1956)

Accredited by MAAC as 'A++' ♦ Approved by AICTE ♦ ISO 21001:2018 Certified  
Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA  
Phone No. +91 8945 - 300 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
Admin Off: 25-35-38, Museum Road, Govenorpet, Vijayawada - 520 002; Ph: +91 - 886 - 3628132, 3576129

Department of Electrical and Electronics Engineering

Program: B. Tech - Electrical and Electronics Engineering

Academic Year: 2022-2023

| Course Code | Course Title                        | CO NO | Description of the Course Outcome  |
|-------------|-------------------------------------|-------|--|
| 22UC1101    | 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  |
| 22UC1202    | 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  |
| 22UC2103    | ESSENTIALS SKILLS FOR EMPLOYABILITY | CO1   | Identify and organize sentence structures based on grammar.  |
|             |                                     | CO2   | Relate Intrapersonal skills  |
|             |                                     | CO3   | Illustrate specific writing skills   |
|             |                                     | CO4   | Interpret interpersonal skills for developing oral communication.  |
| 22UC2204    | CORPORATE COMMUNICATION SKILLS      | CO1   | Extend word power for developing effective speaking and writing skills   |
|             |                                     | CO2   | Evaluate coexistence of the "I" with the body  |
|             |                                     | CO3   | Identify and associate the holistic perception of harmony at all levels of existence.  |
|             |                                     | CO4   | Develop appropriate technologies and management patterns to create harmony in professional and personal lives.   |

*J. Somaiah*  
Dr. JARUPULA SOMLAL  
Professor & HOD  
Department of EEE  
KLEF Deemed to be University  
Green Fields, Vaddeswaram,  
Guntur Dt., A.P-522 302.



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|          |  |     |   |
|----------|--|-----|---|
| 22UC0010 | UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS | CO1 | Understand and analyse the essentials of human values and skills, self-exploration, happiness, and prosperity   |
|          |  | CO2 | Envisage the roadmap to fulfill the basic aspiration of human beings.   |
|          |  | CO3 | Analyze the profession and his role in this existence.  |
|          |  | CO4 | Understand the profession and his role in this existence  |
| 22UC0007 | 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                            |
| 22UC0008 | INDIAN CONSTITUTION                          | CO1 | To acquire knowledge of the historical developments that culminated in the drafting of the Indian Constitution.   |
|          |  | CO2 | To understand the basic features of the Indian Constitution.  |
|          |  | CO3 | To understand the structure of the Federal government as defined by the Indian Constitution.  |
|          |  | CO4 | To understand the Indian Judicial system and election commission of India   |
| 22UC0009 | 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  |
| 22UC0011 | GENDER & SOCIAL EQUALITY                     | CO1 | Students will have developed a better understanding of important issues related to gender in contemporary India   |
|          |  | CO2 | Students will be sensitized to basic dimensions of the biological, sociological, psychological, and legal aspects of gender. This will be achieved through group discussions. |
|          |  | CO3 | Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.   |
|          |  | CO4 | Students will acquire insight into the gendered division of labour and its relation to politics and economics.  |
| 22UC0011 | ENTREPRENEURSHIP                             | CO1 | Learn critical elements of entrepreneurship and its development from institution's perspective  |
|          |  | CO2 | Understand the process of entrepreneurship and its eco system in an educational institute to fit in entrepreneurship zone   |
|          |  | CO3 | Understand & Learn Design Thinking skills towards product innovation & prototype design   |

*S. Sankar*  
**Dr. JARUPULA SOMLAL**  
 Professor & HOD  
 Department of EEE  
 KLEF Deemed to be University  
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 Guntur Dt., A.P.-522 502.





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|          |  |     |  |
|----------|--|-----|--|
|          |  | CO4 | Evaluate the effectiveness of different entrepreneurial strategies   |
| 22MT1101 | 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)  |
| 22LE1005 | MATHEMATICS FOR ENGINEERS                        | CO1 | Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and decompose the matrices.  |
|          |  | CO2 | Apply the Fourier series and Laplace transforms to solve the differential equations.   |
|          |  | CO3 | Apply the probability distributions and Morkov process to predict the output.  |
|          |  | CO4 | Apply the complex variables for flow problems and introduce the Algebraic structures.  |
| 22EE2104 | 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   |
| 22UC1203 | DESIGN THINKING AND INNOVATION                   | CO1 | Understand the importance of Design thinking process for contextualized problems.  |
|          |  | CO2 | Analyze, define, and ideate for solutions  |
|          |  | CO3 | Develop and test the prototype made.   |
|          |  | CO4 | Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity.  |
| 22EE2103 | ELECTROMAGNETIC FIELDS AND ENGINEERING MATERIALS | CO1 | Apply Coulomb's and Gauss's laws to different electrostatic field distributions  |
|          |  | CO2 | Apply Biot-Savart's and Ampere's laws to different magnetic field distributions  |
|          |  | CO3 | Apply the field and force concepts to determine the inductance, capacitance parameters and to estimate boundary conditions.  |
|          |  | CO4 | Understand the properties of Engineering materials   |
|          |  | CO5 | Analyse the field parameter for different field distributions and for different materials  |

*J. Somlal*

**Dr. JARUPULA SOMLAL**  
 Professor & HOD  
 Department of EEE  
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 Green Fields, Vaddeswaram,  
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|          |  |     |   |
|----------|--|-----|---|
| 22CY1001 | ENGINEERING CHEMISTRY                        | 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 apply 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  |
| 22SC1101 | COMPUTATIONAL THINKING FOR STRUCTURED 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 CRUD operations on Basic Data Structures using Asymptotic Notations.  |
|          |  | CO4 | Apply 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.   |
| 22ME1103 | DESIGN TOOLS WORKSHOP                        | CO1 | Demonstrate proficiency in typing sentence, paragraph, report, presentations along with spreadsheets using office tools, LaTeX tools and PowerBI  |
|          |  | CO2 | Build a static website and blog with using HTML along with special features of HTML5, CSS and Javascript  |
|          |  | CO3 | Develop a virtual environment with CSpace and construct a marker-based Augmented Reality and create a 3D terrain  |
|          |  | CO4 | Utilising the software of Autodesk Fusion 360 and the same can be printed in 3D printer as physical prototype, Fundamentals of electrical circuit: Ohm's law, KCL and KVL law               |
| 22SC1209 | IOT WORKSHOP                                 | CO1 | To make the students understand about the programming fundamentals of Arduino Software and Tinkercad  |
|          |  | CO2 | To demonstrate the interfacing of Arduino UNO and ESP32 with LCD, LED, buzzer and Push Button   |
|          |  | CO3 | To design and configure the sensors with Arduino UNO and ESP32 Boards   |
|          |  | CO4 | To design and configure the actuators with Arduino UNO and ESP32 Boards and build Arduino and ESP32 based application   |

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|----------|---------------------------|-----|--|
| 22UC3105 | PROBLEM SOLVING SKILLS-I  | CO1 | Apply the concepts of Linear Equations, concepts of Ratios, Averages, Partnership, Percentages and Interest to solve the problems related to Ages, Ratio & Proportion, Variation & Partnership, Percentages, Profit, Loss & Discounts, Simple & Compound Interest, Averages & Allegations or Mixtures.   |
|          |                           | CO2 | Apply the concepts of Co-primes, Divisibility rules, LCM & HCF concepts to solve problems in Numbers, Apply the concepts of Algebra to solve the problems based on Sets, Relations, Functions and Graphs, Surds & Indices, Logarithms, Quadratic Equations, Inequalities & Progressions.   |
|          |                           | CO3 | Apply Venn diagrams and other applicable diagrams to solve questions in Syllogism, Logical Venn Diagrams, Cubes & Dice. Understand the principles used in forming Number & letter series, Number, letter & word Analogy, Odd man out, Coding & Decoding.   |
|          |                           | CO4 | Understand the underlying assumptions in the arguments presented in the topics: Statements & conclusions, statements & Arguments (Critical Reasoning), statements & Assumptions, logical connectives, Binary logic.  |
| 22ME1103 | 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.  |
| 22SC1202 | DATA STRUCTURES           | CO1 | Understand various sorting algorithms and analyse the efficiency of the algorithms   |
|          |                           | CO2 | Implement and evaluate Linear Data Structures and Demonstrate their applications.  |
|          |                           | CO3 | Implement and evaluate tree data structures and understand hashing techniques  |
|          |                           | CO4 | Understand graph data structures and apply graphs to solve problems.   |
|          |                           | CO5 | Design, Develop and evaluate common practical applications for linear and nonlinear data structures.   |
| 22UC3206 | PROBLEM SOLVING SKILLS-II | CO1 | Apply the concepts of Unitary method in solving problems in Time & Work, Chain Rule, Pipes & Cisterns. Apply the concept of Average speed and Relative speed to solve the problems related to Time, Speed & Distance, Trains, Boats & Streams, Races & games. Apply the concept of counting principles to solve the problems related to Permutations & Combinations and Probability. |

*J. S. S. S.*  
**Dr. JARUPULA SOMLAL**  
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|          |  | CO2 | Apply the concepts of Perimeter, Area, Surface Area & Volume to solve the problems in 2D & 3D Geometry. Apply the concepts of Trigonometry to solve problems related to Heights & Distances. Apply the concepts of Lines, Angles, Triangles, Quadrilaterals & Polygons to solve the problems related to Geometry, Analyzing the data given in the Table, Bar Graph, Pie Chart and Line Graph to solve the problems in Data Interpretation. Data Sufficiency, Statistics, Crypt arithmetic. |
|          |  | CO3 | Apply the fundamental relationships and principles in solving questions in Blood Relations, Directions, Clocks, Calendars, Alphabet Test, Number, ranking & Time sequence test, Seating Arrangements, Mathematical Operations, Data Sufficiency, Nonverbal - series, analogy, classification.  |
|          |  | CO4 | Apply the conditions mentioned in the question statement to solve questions in Input & Output, Assertion and Reason, dot situation. embedded figures, figure matrix, mirror and water images, paper cutting, paper folding pattern completion, rule detection, flowcharts, Puzzles, Sudoku puzzles   |
| 22SC1202 | DATA STRUCTURES                          | CO1 | Understand various sorting algorithms and analyse the efficiency of the algorithms   |
|          |  | CO2 | Implement and evaluate Linear Data Structures and Demonstrate their applications.  |
|          |  | CO3 | Implement and evaluate tree data structures and understand hashing techniques  |
|          |  | CO4 | Understand graph data structures and apply graphs to solve problems  |
|          |  | CO5 | Design, Develop and evaluate common practical applications for linear and nonlinear data structures.   |
| 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 methods to solve electrical circuit using nodal and mesh analysis and apply various network theorems.   |
|          |  | CO2 | Analyse the various properties of Ac circuits and understand the concept of resonance.   |
|          |  | CO3 | Understand the active circuit elements and working.  |
|          |  | CO4 | Understand the applications of semiconductor devices   |

*J. Somlal*  
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|          |  | CO5 | Demonstration of various experiments related to basics of electrical and electronics concepts.  |
| 22SC1101 | COMPUTATIONAL THINKING FOR STRUCTURED DESIGN | CO1 | Develop and apply logical building blocks to solve real world problems  |
|          |  | CO2 | Apply computational thinking for designing solutions  |
|          |  | CO3 | Develop and apply the CRUD operations on arrays   |
|          |  | CO4 | Apply CRUD operations on Linear Data Structures   |
|          |  | CO5 | Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems. . .     |
|          |  | CO6 | Skill the students in such a way that students will be able to develop logic that help them to create programs as well as applications in C       |
| 22EC1101 | DIGITAL LOGIC AND PROCESSORS                 | CO1 | Understand the structure of a digital computer and design combinational circuits for processor using the principles of Boolean Algebra and gates. |
|          |  | CO2 | Analyze the operation of latch/flip-flop and design timing and sequence control circuits using flip-flops   |
|          |  | CO3 | Apply the programmable logic and design digital circuits using Programmable logic devices.  |
|          |  | CO4 | Apply the minimization techniques and Construct optimized combinational and sequential logic circuits.  |
|          |  | CO5 | Design of combinational and sequential circuits with logic gates and flip-flops with verification using Verilog HDL tool                          |
| 22EE2101 | ELECTRICAL CIRCUITS                          | CO1 | Apply two port network principles   |
|          |  | CO2 | Analyse the behaviour of elements to assess the transient behaviour of circuits for AC and DC excitation.   |
|          |  | CO3 | Analyse the voltage and current relations for star and delta three phase balanced and unbalanced circuits   |
|          |  | CO4 | Analyse the impact of coupling and mutual inductance in magnetic circuits.  |
|          |  | CO5 | Experimental verification and analysis of electrical circuits   |
| 22EE2102 | ELECTRICAL MACHINES                          | CO1 | Analyze the performance of single-phase and three-phase Transformers.   |
|          |  | CO2 | Apply the basic principles of electromechanical energy conversion and DC Generators.  |
|          |  | CO3 | Apply the basic principles of electromechanical energy conversion to DC Machines and induction machines.  |
|          |  | CO4 | Apply the basic principles of electromechanical energy conversion to Synchronous Machines.  |
|          |  | CO5 | Test the performance of Electrical Machines.  |

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| 22EE2203  | ELECTRICAL POWER GENERATION TRANSMISSION AND DISTRIBUTION | 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.  |
| 22EC2104R | ANALOG ELECTRONIC CIRCUIT DESIGN                          | CO1 | Apply the knowledge of Semiconductor physics and discuss BJT configurations and its applications             |
|           |   | CO2 | Apply the limitations of BJT and discuss the characteristics and applications of Field Effect Transistors    |
|           |   | CO3 | Apply the linear and nonlinear circuits approaches and realize the characteristics of operational Amplifiers |
|           |   | CO4 | Apply the concept of feedback system and realise the working principles of Oscillators and multivibrators    |
|           |   | CO5 | Design and analyze analog circuits for real-time applications using Passive and Active Components.           |
|           |   | CO6 | Simulate and analyse Electronic Circuit using Multisim and myDAQ.  |
| 22EE2202  | 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   |
| 22EE2204  | POWER ELECTRONICS   | CO1 | Select appropriate switch for a given power converter  |
|           |   | CO2 | Analyze the steady state performance of Basic DC-DC converters   |
|           |   | CO3 | Analyze the performance of Basic Switch-Mode PWM Inverter  |
|           |   | CO4 | Understand the operation of basic phase controlled converters  |
|           |   | CO5 | Test the basic power electronic converters by hardware realization and MATLAB software.                      |
| 22EE3103  | POWER SYSTEM ANALYSIS                                     | CO1 | Apply the knowledge of network matrices for solution of power flow problems                                  |
|           |   | CO2 | Apply the reactance diagrams for Symmetrical short circuit faults in power system                            |
|           |   | CO3 | Apply symmetrical components for unsymmetrical fault analysis in a power system                              |
|           |   | CO4 | Analyze rotor angle stability  |

*J. Somlal*  
**Dr. JARUPULA SOMLAL**  
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| 22EE3101 | 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  |
| 22EE3202 | POWER SYSTEM PROTECTION & CONTROL       | CO1 | Understand the principle of protective relays & circuit breakers   |
|          |   | CO2 | Apply overcurrent, distance and differential schemes for the protection of power system equipment  |
|          |   | CO3 | Analyze over voltage protection and economic operation of power system   |
|          |   | CO4 | Apply automatic generation control and voltage regulators to control power system  |
|          |   | CO5 | Experimental verification of characteristics of different Relays and Operation of power systems  |
| 22EE3102 | MEASUREMENTS AND INSTRUMENTATION        | CO1 | To understand the concepts of Fundamentals of electrical and electronic  |
|          |   | CO2 | To apply instruments for the measurement of voltage, current in ac and dc measurements   |
|          |   | CO3 | To apply the various bridge circuits used with measuring instruments, working of sensors and transducers and their applications.   |
|          |   | CO4 | To apply the concept of digital instrumentation and virtual instrumentation.   |
| 22EE3104 | 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 | Train and test various ANN' s for various applications   |

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 Green Fields, Vaddeswaram,  
 Guntur Dt., A.P.-522 502.



## Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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|          |   |     |  |
|----------|---|-----|--|
| 22EE3201 | EMBEDDED CONTROLLERS & APPLICATIONS                 | CO1 | Understand the architecture and programming concepts of 8086 Microprocessor  |
|          |   | CO2 | Apply the Programming concepts of 8051 Microcontroller   |
|          |   | CO3 | Analyze the Interfacing of Peripherals to the 8051 Microcontroller 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                      |
| 22EE3111 | INDUSTRIAL AUTOMATION AND ROBOTICS                  | CO1 | Understand the automation basics and components  |
|          |   | CO2 | Understand the automation process control  |
|          |   | CO3 | Understand the fundamentals of Industrial Robots   |
|          |   | CO4 | Understand the robotic end effectors and Sensors   |
| 22EE3112 | INTRODUCTION TO INDUSTRIAL INTERNET OF THINGS(IIoT) | CO1 | Understand the Industry 4.0 Globalization  |
|          |   | CO2 | Understand the Model and architecture of IIOT  |
|          |   | CO3 | Understand the IIoT Computing  |
|          |   | CO4 | Understand the Various Applications of IIoT  |
|          |   | CO5 | Apply IIOT Systems Programming IO interfacing with various applications  |
| 22EE3113 | INDUSTRIAL DRIVES AND CONTROL                       | CO1 | Understand Basics of Electric Drives and Dynamics  |
|          |   | CO2 | Understand Closed loop control of DC drives  |
|          |   | CO3 | Understand the Control schemes of BLDC motors  |
|          |   | CO4 | Understand the Programmable control of Drives  |
| 22EE3211 | INDUSTRIAL COMMUNICATION PROTOCOLS & CYBER SECURITY | CO1 | Understand the communication technology protocols & standards  |
|          |   | CO2 | Understand the information security and measurement technology   |
|          |   | CO3 | Understand the introduction to cyber crime   |
|          |   | CO4 | Understand the hacking and cyber-security models   |
| 22EE3212 | SMART SENSORS AND SENSOR NETWORKING                 | CO1 | Understand the basics of smart sensors and micromachining  |
|          |   | CO2 | Understand the sensor communication:   |
|          |   | CO3 | Understand the packaging, testing and reliability of smart sensors:  |
|          |   | CO4 | Understand the wireless sensor networks:   |
|          |   | CO5 | Demonstrate various experiments related to basics of smart sensors and sensor networking   |
| 22EE3121 | SOLAR PV AND MICRO-ENERGY TECHNOLOGIES              | CO1 | Interpret principles and control of Solar PV Energy system   |
|          |   | CO2 | Model and Select Solar PV energy system components   |
|          |   | CO3 | Interpret and Model dynamics of fuel cell energy conversion  |
|          |   | CO4 | Demonstrate ultra-micro-energy energy conversion technologies  |

*J. G. S. L.*  
 Dr. JARUPULA SOMLAL  
 Professor & HOD  
 Department of EEE  
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|          |  |     |   |
|----------|--|-----|---|
| 22EE3122 | WIND AND ENERGY STORAGE TECHNOLOGIES         | CO1 | Interpret principles and control of Wind Energy Conversion                            |
|          |  | CO2 | Model and Select Solar Wind energy conversion system components                       |
|          |  | CO3 | Interpret and Model Electro-chemical energy storage components                        |
|          |  | CO4 | Interpret and Model Mechanical energy storage components                              |
| 22EE3123 | ENERGY MANGEMENT AND GREEN BUILDINGS         | CO1 | Apply energy audit for energy management in buildings                                 |
|          |  | CO2 | Interpret energy conservation opportunities in electrical systems                     |
|          |  | CO3 | Identify energy management strategies for energy efficiency                           |
|          |  | CO4 | Identify practices for energy efficiency green buildings                              |
| 22EE3132 | DISTRIBUTION SYSTEM PRACTICES                | CO1 | Understand the basic structure of distribution system and compute AT&C loss.          |
|          |  | CO2 | Apply the knowledge for erection and commissioning of a substation...                 |
|          |  | CO3 | Understand the various protection systems deployed in distribution system.            |
|          |  | CO4 | Test and understand the test results of various distribution system equipment.        |
|          |  | CO5 | Ability to analyze the best distribution system practices in the microgrid            |
| 22EE3131 | 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 | Monitor various applications in smart grid with its smart infrastructure.             |
| 22EE3133 | ENERGY MANAGEMENT SYSTEMS AND SCADA          | CO1 | Understand SCADA and its architecture.  |
|          |  | CO2 | Understand the application of SCADA in various utilities.                             |
|          |  | CO3 | Apply the knowledge in analyzing various real time applications on transmission side. |
|          |  | CO4 | Apply the knowledge in analyzing various real time applications on distribution side. |
| 22EE3211 | SMART GRID COMMUNICATION AND CYBERSECURITY   | CO1 | Understand the communication technologies for smart grid                              |
|          |  | CO2 | Analyze the information security of smart grid and measurement technologies           |
|          |  | CO3 | Understand the substation standards for communication                                 |
|          |  | CO4 | Analyze the hacking and cybersecurity aspects in smart grids                          |
| 22EE3232 | INTERNET OF THINGS AND SMART GRID ANALYTICS  | CO1 | Understand network protocols and standards  |
|          |  | CO2 | Analyze IoT architecture and data analytics architecture                              |
|          |  | CO3 | Understand various applications of IoT to Smart Grids                                 |
|          |  | CO4 | Analyze the Big Data Analytics  |
|          |  | CO5 | Analyze IoT modules and data analytics for smart grid                                 |

*J. Somaiah*  
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Professor & HOD  
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|          |  |     |  |
|----------|--|-----|--|
| 22EE3141 | POWER TRAIN DESIGN FOR ELECTRIC VEHICLE                  | CO1 | Understand the History, Economics, Environmental issues and power train of Electric Vehicles       |
|          |  | CO2 | Analyze the dynamics of EV   |
|          |  | CO3 | Select and size the power train for 2W   |
|          |  | CO4 | Select and size the power train for 4W   |
| 22EE3142 | 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   |
| 22EE3143 | CHARGING STATION FOR ELECTRIC VEHICLE                    | CO1 | Interpret Power electronic converters for electric vehicle charging                                |
|          |  | CO2 | Develop control algorithms for various electric vehicle charging modes                             |
|          |  | CO3 | Demonstrate charging station infrastructure  |
|          |  | CO4 | Demonstrate installation of charging station   |
|          |  | CO5 | Analyze the converters and control algorithms using Matlab   |
| 22EE3241 | AI and IOT FOR EV  | CO1 | Understand various AI open source tools  |
|          |  | CO2 | Understand various IOT open source tools   |
|          |  | CO3 | Apply AI and IOT for EV performance management   |
|          |  | CO4 | Apply AI and IOT for online vehicle assistance   |
|          |  | CO5 | Apply sensors and embedded programming for cloud data monitoring for electrical vehicle parameters |
| 22EE3242 | COMMUNICATION PROTOCOLS AND TESTING OF EV                | CO1 | Understand the communication protocols used in Electric Vehicles                                   |
|          |  | CO2 | Apply the communication protocols for fault diagnostics of Electric Vehicle                        |
|          |  | CO3 | Analyzethe intricacies of integrating HV and LV components of vehicle                              |
|          |  | CO4 | Understand the overview of system engineering/system validation                                    |
|          |  | CO5 | Test electric vehicle fault  |
| 22EE3221 | AI AND IOT FOR GREEN ENERGY INTEGRATION                  | CO1 | Understand various AI open source tools  |
|          |  | CO2 | Understand various IoT open source tools   |
|          |  | CO3 | Apply AI and IoT for PV energy prediction  |
|          |  | CO4 | Apply AI and IoT for Wind Energy Prediction  |
|          |  | CO5 | Apply AI and IoT technologies for green energy integration solutions                               |
| 22EE3222 | GRID INTEGRATION OF RENEWABLE ENERGY SOURCES             | CO1 | Understand Grid code for integrating PV and Wind power   |
|          |  | CO2 | Identify topologies and interpret control of PV integration to grid                                |
|          |  | CO3 | Identify topologies and interpret control of Wind power integration to grid                        |
|          |  | CO4 | Identify issues and Model active gird management for renewable integration                         |

*J. Sankar*  
 DR. JARUPULA SOMLAL  
 Professor & HOD  
 Department of EEE  
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|          |  |     |  |
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|          |  | CO5 | Able to apply the integration of micro grid  |
| 22EE3105 | RESTRUCTURED 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  |
| 22EE2205 | POWER QUALITY                                  | CO1 | Understand various power quality issues.   |
|          |  | CO2 | Analyze various power quality issues and its causes.   |
|          |  | CO3 | Apply different mitigating techniques for improving power quality  |
|          |  | CO4 | Analyze voltage sag and swell using simulation tools.  |
| 22EE3224 | FLOATING SOLAR AND OFF-SHORE WIND TECHNOLOGIES | CO1 | Understand the selection of floating solar power plant   |
|          |  | CO2 | Understand different layouts and selection of converters   |
|          |  | CO3 | Understand the operation of off shore wind power plants  |
|          |  | CO4 | Analyze the operation of floating solar and off shore power system                                       |
| 22EE3234 | WIDE AREA MONITORING & CONTROL                 | CO1 | Understand the concepts of real-time computer control of power systems and wide area measurement systems |
|          |  | CO2 | Apply Phasor Measurement Units for reliable Operation of Power System . . . . .                          |
|          |  | CO3 | Apply Fault Detection Isolation Restoration (FDIR) Concepts for Protection.                              |
|          |  | CO4 | Understand voltage stability concepts for Wide area protection.  |
| 22EE4133 | SMART APPLIANCES AND SMART CITIES              | CO1 | Apply smart city principles  |
|          |  | CO2 | Apply smart device design principles   |
|          |  | CO3 | Apply IoT systems for smart city   |
|          |  | CO4 | Apply Data processing and application development using smart devices                                    |
| 22EE4123 | MICROGRID DYNAMICS AND CONTROL                 | CO1 | Analyze challenges in microgrids   |
|          |  | CO2 | Analyze dynamics of micro grids  |
|          |  | CO3 | Analyze hierarchical microgrid control   |
|          |  | CO4 | Analyze DC microgrids  |
| 22EE3244 | SWITCHED MODE POWER SUPPLY DESIGN              | CO1 | Analyze Power converters for Switched mode power supply  |
|          |  | CO2 | Design components for switched mode power supply   |
|          |  | CO3 | Analyze output stage operation of SMPS   |
|          |  | CO4 | Design resonant SMPS   |

*J. Somaiah*  
**Dr. JARUPULA SOMLAL**  
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|----------|--|-----|---|
| 22EE4143 | ADVANCED ELECTRICAL DRIVES                   | CO1 | Analyze Mathematical Models of AC machines  |
|          |  | CO2 | Contrast the speed control performance of 3-Phase induction and synchronous motor drive using vector control methods  |
|          |  | CO3 | Analyze the dynamic behavior of SRM motor drives under various control methods  |
|          |  | CO4 | Analyze the performance of BLDC Motor drive using various control techniques  |
| 22EE3214 | DATA SCIENCE APPLICATION FOR AUTOMATION      | CO1 | Understand basics of data science   |
|          |  | CO2 | Understand the big data handling in automation  |
|          |  | CO3 | Apply the data handling techniques using python   |
|          |  | CO4 | Apply the numpy and panda models  |
| 22EE4113 | MACHINE LEARNING APPLICATIONS FOR AUTOMATION | CO1 | Understand basic AI algorithms  |
|          |  | CO2 | Understand the AI & ML concepts   |
|          |  | CO3 | Apply the ML algorithms for automation data   |
|          |  | CO4 | Understand the system experts in automation model   |
| 22EE4124 | MICROGRIDS                                   | CO1 | Understand the concept of Microgrid   |
|          |  | CO2 | Apply the various communications in microgrid   |
|          |  | CO3 | Apply smart metering technology   |
|          |  | CO4 | Apply energy management in microgrids   |
| 22EE3215 | FOUNDATIONS OF CYBER PHYSICAL SYSTEMS        | CO1 | Understand the CPS basics   |
|          |  | CO2 | Understand the CPS software Components  |
|          |  | CO3 | Understand the security and safety in CPS   |
|          |  | CO4 | Understand the deployment of CPS model  |
| 22EE3216 | CPS NETWORK & PROTOCOLS                      | CO1 | Understand the concepts required for building industrial systems  |
|          |  | CO2 | Understand the network bud architectures and protocols  |
|          |  | CO3 | Understand the CPS Architecture & Enabling Technologies   |
|          |  | CO4 | Understand the CPS security models  |
| 22EE4114 | CYBER SECURITY                               | CO1 | To introduce students to the fundamental concepts of cyber crime, including target identification, vulnerabilities, attack tools, and methods.                        |
|          |  | CO2 | To equip students with knowledge about authentication, secure password generation, encryption, digital signatures, and cybersecurity standards.                       |
|          |  | CO3 | Apply safe practices while using social networking platforms, including protecting personal information, email security, and participating in groups and communities. |
|          |  | CO4 | To raise awareness about smartphone security, secure communication methods, and precautions for maintaining privacy while using smartphones.                          |

*J. Somaiah*  
**Dr. JARUPULA SOMLAL**  
 Professor & HOD  
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| 22EE4133 | DATA SCIENCE APPLICATIONS FOR SMART GRID      | CO1 | Understand the integration of data science techniques in smart grid systems.                    |
|          |   | CO2 | Apply data analysis for optimizing energy consumption and distribution in smart grids           |
|          |   | CO3 | Employ machine learning algorithms for predictive maintenance and load forecasting              |
|          |   | CO4 | Analyze case studies to grasp practical applications of data science in smart grids             |
|          |   | CO5 | Analyze the modules of data science in smart grids  |
| 22EE3112 | INTRODUCTION TO INDUSTRIAL INTERNET OF THINGS | CO1 | Understand the Industry 4.0 Globalization   |
|          |   | CO2 | Understand the Model and architecture of IIOT   |
|          |   | CO3 | Understand the IIoT Computing   |
|          |   | CO4 | Understand the Various Applications of IIOT   |
|          |   | CO5 | Apply IIOT Systems Programming IO interfacing with various applications                         |
| 22EE2191 | HVDC & FACTS                                  | CO1 | Understand various HVDC transmission systems converter circuits and its control scheme          |
|          |   | CO2 | Analyze the FACTS devices for improving system stability  |
|          |   | CO3 | Analyze the knowledge for improving stability in Power System                                   |
|          |   | CO4 | Apply the concepts of harmonics for designing of AC filters                                     |
| 22EE3181 | NON-ISOLATED POWER CONVERTERS                 | CO1 | Understand operation principle of Power Switches  |
|          |   | CO2 | Apply the Principles of ac-dc converters  |
|          |   | CO3 | Analyze dc-dc conversion circuits   |
|          |   | CO4 | Analyze the Principles of dc-ac conversion circuits   |
| OEEE0013 | RENEWABLE ENERGY SOURCES(RES)                 | CO1 | Utilize the different solar thermal applications and solar photovoltaic cells                   |
|          |   | CO2 | Identify different types of wind turbines and wave energy conversion                            |
|          |   | CO3 | Apply various energy conversion techniques of Tidal, ocean thermal and geo thermal power plants |
|          |   | CO4 | Develop Bio energy conversion method and bio gas plants   |
| OEEE0014 | ENERGY ESTIMATION AND AUDIT                   | CO1 | Understand the present power scenario in India and need for energy estimation and Audit.        |
|          |   | CO2 | Utilize the Induction motor for energy conservation opportunities.                              |
|          |   | CO3 | Select the transformers and cables for energy conservation opportunities.                       |
|          |   | CO4 | Select the Lighting systems, pumping systems for energy conservation opportunities.             |
| OEEE0015 | ELECTRICAL POWER TECHNOLOGY                   | CO1 | Understand working of various generating stations and economical aspects of generation          |
|          |   | CO2 | Apply the Kirchhoff's laws for calculating circuit parameters                                   |

*J. Somlal*  
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|           |   | CO3 | Apply the faraday's laws for the construction and performance analysis of different types of electrical machines   |
|           |   | CO4 | Apply energy conservation opportunities for various electrical appliances  |
| 22MT2005  | PROBABILITY, STATISTICS & QUEUEING THEORY | CO1 | Understand the importance of probabilistic concepts in a wide spectrum of problems arising in engineering applied science.   |
|           |   | CO2 | Identify the relationship between variables using correlation and regression techniques  |
|           |   | CO3 | Explain the role of Statistical tests of significance in solving real world engineering problems   |
|           |   | CO4 | To formulate Stochastic process in terms of Markov chains and solve problems in queueing systems, and network  |
| 22SDEE01R | APPLICATION DEVELOPMENT USING PYTHON      | CO1 | Implement Python Operators, Conditional statements, Collection Data Types and Functions, Implementing Array through NumPy, Plotting, Visualization through matplotlib  |
|           |   | CO2 | Apply various machine learning algorithms to solve problems through Scipy and Scikit learn   |
|           |   | CO6 | Analyse various machine learning algorithms to solve real world problems in Energy management, Electric drives, smart grid and automation using machine learning algorithms with Python                            |
| 22MT2008  | COMPLEX ANALYSIS AND TRANSFORM TECHNIQUES | CO1 | Apply Cauchy-Riemann equations to test the analyticity of a complex function and Compute the complex integrals, using Cauchy theorem and Cauchy Integral formulae.   |
|           |   | CO2 | Represent analytic functions as Taylor, Maclaurine and Laurent series expansions and compute real and complex integrals using the Residue theorem. Also transform complex functions using bilinear transformation. |
|           |   | CO3 | Compute Fourier transforms using integrals and solve differential equations  |
|           |   | CO4 | Apply Z- transforms to solve difference equations  |
| 22UC0021  | SOCIAL IMMERSIVE LEARNING                 | CO1 | Extension Activities and Social Outreach activities (ESO)  |
|           |   | CO2 | Technology Clubs (TEC)   |
|           |   | CO3 | Liberal arts, creative arts and hobby clubs (LCH)  |
|           |   | CO4 | Innovation, Incubation & Entrepreneurship (IIE)  |
|           |   | CO5 | Health & Well Being (HWB)  |

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