Koneru Lakshmaiah Education Foundation

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Department of Electrical and Electronics Engineering
Program: B.Tech -Electrical and Electronics Engineering
Academic Year: 2020-2021

Course Code	Course Title	CO NO	Description of the Course Outcome
20EE2101	ELECTRICAL CIRCUITS	CO1	Apply the transient behaviour of DC & AC circuits and Two port networks.
		CO2	Apply network topology concepts to electrical networks
		CO3	Understand the Transient response of series and parallel circuits
		CO4	Analyze the physical circuits with two port networks
19EE2102	ELECTRICAL POWER ENGINEERING	CO1	Understand the working of various generating stations and economical aspects of generation
		CO2	Understand the electrical design aspects of transmission and distribution systems
		CO3	Understand the Mechanical design aspects of transmission and distribution systems
		CO4	Understand the automatic generation control and the role of automatic voltage regulators
19EE2103	ELECTRICAL MACHINES	CO1	Understand the basic principles of electro mechanical energy conversion.
		CO2	Apply the suitable technique for finding the performance of DC machines.
		CO3	Analyse the performance of Transformers
		CO4	Analyse the voltage regulation of an alternator and the load sharing.
		CO5	Analyse the performance of Electrical Machines.
19EE2201	INDUSTRIAL APPLICATIONS OF ELECTRICAL MACHINES	CO1	Understand the concepts of the 3- phase induction motor
		CO2	Select different speed control and starting methods of induction machine.
		CO3	Analyze the performance of 3 phase synchronous motor
		CO4	Select a suitable motor for industrial applications.
		CO5	Test the performance of Electrical Machines for various applications.
20EE2202	POWER ELECTRONICS	CO1	Select appropriate switch for a given power converter
		CO2	Analyse the operation and performance of DC-DC Converters
		CO3	Analyze 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 NR method in apower system and also obtain solution for symmetrical and unsymmetrical faults in a power system using Symmetrical components
		CO2	Understand the principle of protective relays & circuit breakers
		CO3	Understand overcurrent, distance and differential schemes for the protection of power system equipment

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		CO4	Understand various aspects of power system stability
		CO5	Experimental verification of power system analysis, characteristics of different Relays and Operation and stability of power systems through programming/simulation
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
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
19EC2106	EMBEDDED CONTROLLERS	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
20EE2104	Mathematical Transforms for Signal Processing	CO1	Capable to understand basic concepts related to Signal Processing System
		CO2	Able to understand the Signal Processing Algorithms
		CO3	Analyse the Filter design Methodologies
		CO4	Demonstrate various applications related to signal processing concepts
19PH1006	MATERIALS AND MEASUREMENTS	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.

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Code	Course	CO	Description
		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.
20EE3201	ELECTRIC DRIVES	CO1	Demonstrate steady state and dynamic behaviour of electric drives
		CO2	Interpret and Model control of dc motor based electric drives
		CO3	Interpret and model scalar methods for Induction Motor speed control
		CO4	Interpret and Model vector control of Modern Industrial Motor Drives
20EE3202	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
19BT1001M	BIOLOGY FOR ENGINEERS	CO1	Relate and understand the basics of biology
		CO2	List and summarise the systems of life
		CO3	Recognise and understand the importance of diet and nutrition
		CO4	Describe and categorise the microorganisms and their applications
19EC2103	ANALOG ELECTRONIC CIRCUIT DESIGN	CO1	Design BJT Amplifiers.
		CO2	Design JFET Amplifiers
		CO3	Design OP-Amp Linear & Non-linear applications.
		CO4	Design oscillators and Power Supplies using ICs.
		CO5	Design and Testing of Analog circuits for real life applications
19EE3121	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
19EE3122	WIND AND ENERGY STORAGE TECHNOLOGIES	CO1	Understand the principles and control of Wind Energy Conversion System
		CO2	Apply the Wind energy conversion system to electrical grid
		CO3	Apply the electro-chemical energy storage systems to power systems
		CO4	Apply the Mechanical energy storage systems to power systems
20EE3221	ENERGY MANAGEMENT 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
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

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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
20EE3231	ENERGY MANAGEMENT SYSTEMS AND SCADA	CO1	Able to understand SCADA and its architecture.
		CO2	Able to understand the application of SCADA in various utilities.
		CO3	Able to understand EMS and apply the knowledge in analyzing various real time applications on transmission side.
		CO4	Able to understand DMS and apply the knowledge in analyzing various real time applications on distribution side.
19EE3141	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
20EE3241	CHARGING STATIONS FOR ELECTRIC VEHICLES	CO1	Understand Control Algorithms for Various Electric Vehicle Charging Modes
		CO2	Apply Power Electronic Converters for Electric Vehicle Charging
		CO3	Apply Charging Station Infrastructure
		CO4	Understand Installation and site assessment of Charging Station
20EE3222	AI AND IOT FOR GREEN ENERGY INTEGRATION	CO1	Understand the usage of basic cloud services
		CO2	Apply Embedded Programming to upload sensor data to cloud
		CO3	analyze the data in cloud through AL/ML Services
		CO4	Develop application for green energy technologies using cloud tools
20EE3223	GRID INTEGRATION OF RENEWABLE ENERGY SOURCES	CO1	Apply the control principles for PV - grid integration control
		CO2	Apply the control principles for wind power integration control
		CO3	Identify power quality challenges in grid integration of renewable energy
		CO4	Identify challenges in grid integration of multiple renewable sources
20EE3232	SMART GRID COMMUNICATION AND CYBERSECURITY	CO1	Understand the communication technologies for smart grid
		CO2	Applying the information security to smart grid and measurement technologies
		CO3	Understand the Interoperability standards for communication
		CO4	Apply the hacking and cybersecurity aspects in smart grids
20EE3242	AI AND IOT FOR ELECTRIC VEHICLE	CO1	Understand the usage of basic cloud services
		CO2	Apply embedded programming to upload sensor data to cloud
		CO3	Analyze the data in cloud through AL & ML services
		CO4	Develop application for electric vehicles using cloud tools
20EE3243	COMMUNICATION PROTOCOLS AND	CO1	Understand the communication protocols used in Electric Vehicles
		CO2	Apply the communication protocols for fault diagnostics of Electric Vehicle

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	TESTING OF ELECTRIC VEHICLE	CO3	Analyze the intricacies of integrating HV and LV components of vehicle
		CO4	Understand the overview of system engineering/system validation
19EE3106	SENSORS AND INTERNET OF THINGS	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
19EE3112	INTRODUCTION TO INDUSTRIAL INTERNET OF THINGS	CO1	Understand the Industry 4.0 Globalization
		CO2	Apply the Model and architecture of IIOT
		CO3	Understand the IIoT Computing
		CO4	Design and validate the Various Applications of IIoT
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
20TS3202E	TECHNICAL PROFICIENCY - II (AUTOCAD ELECTRICAL, POWERWORLD SIMULATOR AND IOT))	CO1	Understand the process of developing an electrical schematic using CAD software(s).
		CO2	Analyze an electrical schematic using the CAD software for his/ her selected application.
		CO3	Understand the procedure to create a new project using PSA software(s).
		CO4	Analyze various power system scenarios using modeling and analysis software.
20EE1201	Basics of Electrical & Electronics Engineering	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
20EE3211	INDUSTRIAL DRIVES AND CONTROL	O1	Select and size electric drive for industrial automation
		CO2	Analyze dc drives for industrial automation
		CO3	Analyze ac drives for industrial automation
		CO4	Utilize special motors and programmable logic controllers for industrial drive control
20EE3212	INDUSTRIAL COMMUNICATION PROTOCOLS AND CYBER SECURITY	CO1	Understand the Industrial data communication Technologies
		CO2	Understand the Various Industrial protocols and standards
		CO3	Understand the concept of information security and hacking tools
		CO4	Apply knowledge on concept of Cybercrimes and Malwares
20EE3213		CO1	Understand the basics of smart sensors and micromachining

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	SMART SENSORS AND SENSOR NETWORKING	CO2	Apply the sensor communication protocols
		CO3	Apply the packaging, testing and reliability of smart sensors:
		CO4	Understand the wireless sensor networks
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
20FL3055	GERMAN LANGUAGE	CO1	Understand the German language, with greeting wishes, alphabets and numbers learning.
		CO2	Comprehend the German articles and conjugation with present, past and future tense
		CO3	Characterize to build a sentence with suitable prepositions, questions, and possessive pronouns, and the importance of four fallls in German Language
		CO4	Understand about how to move in public places, such as shopping centres, restaurants, tourist places, etc, and preparation of them for German A1 level examination
19CY1101	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 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
20FL3058	JAPANESE LANGUAGE	CO1	Understand General features of Japanese, Introduction toWriting, Everyday Greetings and expressions
		CO2	Frame verb sentence 1 and verb sentence 2
		CO3	Frame sentences with i-adjective
		CO4	Frame sentences using the na-adjective
20FL3054	FRENCH LANGUAGE	CO1	Acquire a working knowledge of the basic elements of the French language viz. letters, vowels, accents, articles, useful expressions, etc.
		CO2	Frame questions and respond in the affirmative or negative with être and avoir and form plurals
		CO3	Understand and apply the adjectives and essential verbs.
		CO4	Comprehend and use in speech, vocabulary, reading, questions and answers on passages pertaining to Monuments of France.
OEBT0001	IPR AND PATENT LAWS	CO1	Acquire the knowledge of intellectual property rights
		CO2	Describe the principles and regulatory affairs
		CO3	Develop documentation ,Protocols and Case Studies on Patents
		CO4	Compare various Case Studies on Patents

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20IE3250	MID GRAD CAPSTONE PROJECT - II	CO1	Choose problem/task specification, select, collect and use required information/knowledge to implement the task and obtain a possible solution
20IE4150	CAPSTONE PROJECT- I	CO1	Choose problem/task specification, select, collect and use required information/knowledge to implement task and obtain possible solution
		CO2	Identify, discuss and justify the technical aspects of the chosen area for problem analysis
		CO3	Reproduce, improve and refine technical aspects for chosen problem
		CO4	Communicate and report effectively project related activities and findings.
20UC0009	ECOLOGY & ENVIRONMENT	CO1	Define to articulate basic understanding of the importance of Environmental education and conservation of natural resources. conservation of natural resources and Energy resources
		CO2	Understand concepts of ecosystems and learn methods for conservation of habitats and biodiversity
		CO3	Identify critically about individual roles in prevention of pollution. An Environmental Studies will be enable to do independent research on human interactions with the environment
		CO4	Recognize the knowledge on environmental legislation, disaster management and EIA process.
20MB4059M	SEARCH ENGINE OPTIMIZATION	CO1	Able to understand the foundational elements of how the most popular search engine. future.
		CO2	Able to understand how search engine algorithms and how they affect organic search results and websites.
		CO3	Able to understand how to select and apply appropriate keywords throughout a website for optimization.
		CO4	Able to understand how the content marketing and social media ecosystems are interconnected and drive search results to a website.
OECE0002	ENVIRONMENTAL POLLUTION CONTROL METHODS	CO1	Understand the effects and control methods of air pollution
		CO2	Discuss the sources and effects of water pollution and control methods.
		CO3	Understand the sources, effects and treatment method of waste water and Noise pollution
		CO4	Discuss the sources and effects of solid waste and solid waste management and Applying the design criteria to construction of landfills
20MB4062	CONSTRUCTION PROJECT MANAGEMENT	CO1	Understand construction principles and techniques to effectively plan and execute construction projects.
		CO2	Understand about construction project scheduling, cost estimation, and resource allocation for a particular project
		CO3	Understand about the Construction Methods and Techniques
		CO4	Understand about the Construction Project Cost Estimation and Control.

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20SC1203	OBJECT ORIENTED PROGRAMMING	CO1	To understand basic Concepts of OOP, fundamentals of java and apply the concepts of classes and objects through Java Language
		CO2	To apply constructors, Overloading, parameter passing, access control in Java programming.
		CO3	To apply Inheritance, Abstraction and Interfaces
		CO4	To apply Exception Handling, I/O Streams and understand Basic Concepts of Multithreading
		CO5	To apply OOP concepts to write programs and implement projects in java.
OECS0008	FUNDAMENTALS OF INFORMATION TECHNOLOGY	CO1	Understand the architectural design of a computer and various basic concepts of operating systems
		CO2	Understand programming fundamentals Analyse various software development methodologies
		CO3	Understanding of database design and Apply various SQL commands and Transaction Processing.
		CO4	Apply OOP and model for different case studies using UML
20UC4001	SOCIAL WORK	CO1	Ability to discuss the major influences in the development of social work and the social welfare system in Indian Society.
		CO2	Understand the values of social work and consciously apply those in practice.
		CO3	Develop skills to understand contemporary reality in its historical context.
		CO4	Greater awareness of their personal suitability and/or readiness for choosing social work as a profession.
20TS3101E	Technical Proficiency Training - I	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
20UC0007	INDIAN HERITAGE & CULTURE	CO1	Familiarizing students with various aspects of Indian culture and how they contribute to the concept of Indian culture
		CO2	Understand the beginnings of Indian History and the developments
		CO3	Understand the developments in India during the Medieval Age along with how they contributed to Indian civilization.
		CO4	Understand the reasons for colonial rule over India and how independence was achieved from British rule

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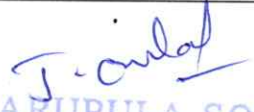(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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20UC0009M	ECOLOGY AND ENVIRONMENT	CO1	Understand the Basic concepts of environment
		CO2	understand the concepts of ecosystems and learn methods for conservation of habitats and biodiversity
		CO3	Understand the concepts of environmental degradation in context of species
		CO4	Understand the various forms of pollution and its impact
20UC0010	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	CO1	Realize the basic aspiration and understanding harmony in the human being. Understand the process of Self-exploration and able to differentiate between right and wrong
		CO2	Realize how to achieve harmony in self, body and family. Understand the content of continuous happiness and prosperity (basic requirements and basic aspiration) and current scenario of happiness and prosperity.
		CO3	Realize ways to attain harmony in society and in nature. Realize the root cause of the techno-genic maladies and able to identify the solution and understand harmony in the human being.
		CO4	the profession and his role in this existence. Realize the co-relation between lack of human values and prevailing problems.
20UC0011	ENTREPRENEURSHIP	CO1	ENTREPRENEURSHIP THEME
		CO2	ENTREPRENEURSHIP FOUNDATION
		CO3	ENTREPRENEURSHIP QUALITY
		CO4	ENTREPRENEURSHIP ICUBATION
20UC2204	CORPORATE COMMUNICATION SKILLS	CO1	Understand how to Speak from the script, Product & Process Description, Presenting Arguments, Paragraph writing
		CO2	Understand how to set a Goal and how to build a Team and manage Time and Leadership
		CO3	Understand the properties of numbers, solving the problems on divisibility rules, unit's digit, remainders, Percentages and its applications like Profit and Loss and Simple and Compound Interest. Understand the concept of Permutations combinations and Probability.
		CO4	Understand Inductive Reasoning to find the answers in Series, Analogy odd man out and coding and Decoding. understand the concepts of clocks and Calendars
OEAD0002	DATA SCIENCE AND VISUALIZATION	CO1	AI, Machine Learning and Data Science, Definition of Data Science, Extracting Meaningful patterns, building representative models, Statistics ML and Computing, Learning Algorithms, Data Science Classification, Data Science Algorithms, Data Science process, Prior knowledge, Data Preparation, Modelling, Application, Different types of Analytics: Descriptive Analysis, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis

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Accredited by **NAAC** as 'A++' ❖ Approved by AICTE ❖ ISO 21001:2018 Certified

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		CO2	Analysis EXPLORATORY DATA ANALYSIS: Objective of Data Exploration, Different types of datasets: Numerical or Continuous, Categorical or Nominal, Population and Sample Descriptive Statistics, Univariate Exploration, Multivariate Exploration, EDA through Data Visualization, Univariate Visualization, multivariate Visualization, hypothesis testing, t-test, z-test, Anova, p-values
		CO3	Ability to analyze time series data through various tools in Data Science
		CO4	Ability draw data visualization for different types of data
OEBT0003	COMPUTER AIDED DRUG DESIGN	CO1	To apply Computer-Aided Drug Design methods and its importance in drug discovery
		CO2	To apply the concepts of database mining for macromolecular targets and small molecules for their structural interactions.
		CO3	To apply common methods involved in Computer-aided drug design including structure modeling, biomolecular interactions, virtual screening, QSAR, and ADMET properties
		CO4	To apply the concepts of drug design in real word scenarios, pitfalls and scope of Computer-aided drug design
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.
OEEC0011	IMAGE PROCESSING	CO1	Understand the fundamental concepts of a digital image processing system and transformation techniques
		CO2	Understand image enhancement techniques in spatial and frequency domains
		CO3	Understand image restoration and compression techniques.
		CO4	Comprehend image segmentation, representations, and description

Dr. JARUPULA SOMLAL

Professor & HOD

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KLEF Deemed to be University

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