



# Koneru Lakshmaiah Education Foundation

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

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Department of Electronics and Communication Engineering

Program: M.Tech.- Embedded Systems

Academic Year: 2023-25

COURSE CODE	COURSE NAME	CO NO	COURSE OUTCOME
23RA5001	NON-LINEAR SYSTEMS AND CONTROL OPTIMIZATION	1	Introduce the need and concept of nonlinear system and optimizations for robotics
		2	Impart knowledge about different strategies adopted in the of nonlinear systems for robotics engineering
		3	Apply constrained optimization to various physical systems. Implement optimal control algorithms to track the response of the system through a predefined trajectory
		4	Familiarize with the design of different types of nonlinear Robotics controllers
23ES5101	Embedded Controllers & SOCs	1	Understand the concept of embedded system, microcontroller, different components of a microcontroller, and their interactions.
		2	Get familiarized with the programming environment to develop embedded solutions.
		3	Program ARM microcontroller to perform various tasks.
		4	Understand the key concepts of embedded systems such as I/O, timers, interrupts, and interaction with peripheral devices.
23ES5102	EMBEDDED HARDWARE AND SOFTWARE CO-DESIGN	1	Able to Understand the fundamental concepts of embedded systems, including their definition, classification, purpose, and core components.
		2	Able to identify and apply the different computational models used in embedded system design.
		3	Able to apply the knowledge to design and develop embedded hardware and firmware.
		4	Able to apply knowledge to prototype, emulate, test, and package embedded systems.

<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>CO NO</b>	<b>COURSE OUTCOME</b>
23ES5103	M2M TECHNOLOGY: IOT	1	Able to Understand the basics of IoT, including its technologies, architecture, and design methodologies
		2	Able to Understand the hardware and software components of IoT systems, as well as the security and application development.
		3	Able to understand the challenges and solutions for M2M communication in constrained devices and able to design and implement M2M communication solutions for real-world applications.
		4	Able to understand IoT data management and analytics, as well as the design and commercialization of IoT products and services.
23EC5101	Artificial Intelligence and Machine Learning	1	Understanding of basic search algorithms
		2	Study and applications of ANN and deep learning
		3	Application of various ML techniques of kMeans, kNN, SVM and GMM
		4	Understand various advanced computing methods
23ES5204	REAL TIME EMBEDDED SYSTEMS	1	Apply the task-scheduling algorithms for real-time systems and embedded application
		2	Apply Multiprocessor scheduling and real-time communication, databases, and synchronization.
		3	Apply an RTOS and be able to interpret the feasibility of a task set to accomplish and Timers.
		4	Analyse model-driven development approaches to construct an execution environment with case studies.
23ES5105	IoT System Design Techniques	1	Understand various building blocks and working of state-of-the-art IoT systems and IoT system design enabling technologies.
		2	Understand the Real-world design constraints and design and develop the system with Hardware and software tools.
		3	Understand the Product Design and Development process and gain enough insights to conceive and build IoT systems on their own
		4	Apply the design concepts for Industrial IoT and Health Care applications.

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23ES5301	Advanced Embedded System Design	1	Understand the ARM Cortex-M4 architecture of embedded systems
		2	Understand the onboard protocols used in the Embedded system and testing and debugging.
		3	Design concepts needed to build an embedded system using RTOS
		4	Analyze the insights of RTOS internal design and implementation
23ES5302	DIGITAL TWINS MODEL-BASED EMBEDDED SYSTEMS	1	Implement fundamental image processing techniques required for computer vision.
		2	Apply Hough Transform for line, circle, and ellipse detections
		3	Apply 3D vision techniques. Implement motion-related techniques; develop applications using computer vision techniques.
		4	Understands motion analysis. To study some applications of computer vision algorithms.
23ES5303	RECONFIGURABLE HARDWARE DESIGN	1	Understand the foundational principles of reconfigurable hardware design, including the architecture and components of Field-Programmable Gate Arrays (FPGAs)
		2	Demonstrate proficiency in using Hardware Description Languages (HDLs) such as Verilog or VHDL
		3	Develop the ability to design and implement complex digital systems using reconfigurable hardware, incorporating concepts such as finite state machines
		4	Analyzing timing constraints, performing timing analysis, and optimizing reconfigurable hardware designs to meet performance requirements
23ES5304	Data Bases, Data Modeling & Data Structure	1	Understanding of database systems and architecture, and data models.
		2	Understand and characterize modern techniques of database information.
		3	Understand the concept of database to identify information and ER Modelling.
		4	Apply the concurrency control, recovery, security, and indexing for the real-time data

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23IE5149	TERM PAPER	1	Enhancing the skill sets in research by recognizing and identifying problems, exploring/defining the problem by gathering information, formulation of the research objectives, and addressing the problem through scientific process and methods.
23ES5402	IOT & EDGE COMPUTING AND MOBILE APPLICATIONS	1	Understand various Edge computing scenarios and case studies.
		2	Understand the Edge computing Architectures and protocols.
		3	Develops mobile computing and standardized hardware and software platforms.
		4	Apply the Edge concepts for Mobile application development.
23ES5403	System on Chip Design	1	Acquire knowledge about Top-down SoC design flow
		2	Understand the system-level design of communication networks.
		3	Apply system-level design and analyze MPSoC concepts
		4	Acquire knowledge about NoC
23ES5404	Block Chain & Cyber Security	1	Understand emerging abstract models for Blockchain Technology
		2	Analyze the concept of bitcoin and the mathematical background behind it
		3	Apply the tools for understanding the background of cryptocurrencies
		4	Identify major research challenges and technical gaps existing between theory and practice in the cryptocurrency domain
23ES5401	ADVANCED EMBEDDED SOFTWARE DEVELOPMENT	1	Understanding of the principles and concepts underlying embedded systems
		2	Apply the code for memory usage, performance, and power efficiency in embedded systems
		3	Developing, configuring RTOS into embedded systems, including task scheduling, resource management, and synchronization mechanisms.
		4	Apply techniques for debugging and optimizing embedded software, including the use of debugging tools, code profiling, and performance analysis

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23ES5502	SYSTEMS FOR SMART CITY AND SMART VILLAGE	1	Understanding the systems and smart systems with local requirements issues and solutions
		2	Apply of System for smart villages with different modules of smart villages with privacy and security
		3	Apply System for smart cities with different management modules of smart cities.
		4	Apply the next generation needs for smart Systems and Smart Global System.
23ES5503	MICRO- AND NANO-EMBEDDED SYSTEMS	1	Understanding of the principles and concepts underlying micro- and nano-embedded systems, including their architectures, design methodologies
		2	Apply the skills in programming microcontrollers and nanodevices, including low-level programming languages
		3	Design and implement micro- and nano-embedded systems for specific applications, incorporating sensors, actuators, communication interfaces.
		4	Explore emerging trends in IoT, wearable devices, biomedical implants, and energy harvesting.
23ES5501	INDUSTRIAL AUTOMATION SYSTEM DESIGN	1	Understanding of the principles and concepts underlying industrial automation systems, including sensors, actuators, control systems
		2	Apply the skills in programming Programmable Logic Controllers (PLCs) using ladder logic or other programming languages
		3	Demonstrate the ability to design and integrate control systems for industrial automation applications.
		4	Design and implement Human-Machine Interfaces (HMIs) for industrial automation systems.
23ES5504	Energy Harvesting Technologies for IoT	1	Understand the concepts of renewable energy systems and energy harvesting for WSN.
		2	Understand the solar energy harvesting technologies and designing solar power systems for IoT.
		3	Apply mechanical energy harvesting technology for WSN and design a system for real-world problems
		4	Apply Electromagnetic energy harvesting technologies for small-power applications and current research on hybrid systems.

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23ES5601	Optimization algorithms for autonomous systems	1	Understand Machine Learning based Optimization models for various problem-specific solutions.
		2	Apply evolutionary programming and strategies in engineering aspects.
		3	Design Mathematical Models of Genetic Algorithms fitness functions.
		4	Apply and analysis of advanced autonomous optimization techniques.
23ES5602	IIoT 4.0 for Automation in Industries	1	Knowledge of theory and practice related to Industrial IoT Systems
		2	Ability to identify, formulate and solve engineering problems by using Industrial IoT
		3	Knowledge of the design and analysis of Cyber-Physical System
		4	Ability to implement real field problems by gaining knowledge of Industrial applications.
23ES5603	MEMS SENSORS AND ACTUATORS	1	Ability to understand the operation of micro devices, micro systems and their applications
		2	Ability to design the micro devices, micro systems using the MEMS fabrication process
		3	Gain a knowledge of basic approaches for various sensor design
		4	To understand various MEMS based sensors for various applications
23ES5604	Cyber Physical Systems	1	Understand the basics of cyber physical systems.
		2	Enumerates several fields where cyber-physical systems are widely used.
		3	Design and develop robotics algorithms and cyber physical systems
		4	Apply modern tools to develop CPS applications
21IN5204	Big data Analytics for IoT	1	Big Data Science and Machine Intelligence
		2	Machine Learning for Big Data in Healthcare Applications
		3	Apache Hadoop and Apache Spark
		4	Data Analytics using Azure