



## Koneru Lakshmaiah Education Foundation

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

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

Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in


Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

Department of Electronics and Communication Engineering


Program: M. Tech – Robotics and Automation

Academic Year: 2023-25


Course Code	Course Name	CO NO	CO Description
23RA5001	NON-LINEAR SYSTEMS AND CONTROL OPTIMIZATION FOR ROBOTICS	1	Understanding of non-linear systems and their behavior, including stability, equilibrium points, and nonlinear dynamics
		2	Apply control techniques to model and control robotic systems effectively, considering factors such as dynamics, constraints, and uncertainties
		3	Apply constrained optimization to various physical systems and implement optimal control algorithms to track the response of the system through a predefined trajectory
		4	Apply the optimization techniques relevant to robotics, including gradient-based optimization, evolutionary algorithms, and convex optimization methods
23RA5101	ROBOTICS: CYBER PHYSICAL SYSTEMS	1	Ability to understand cyber -physical systems are and highlight the main challenges they currently face
		2	Ability to Enumerates several fields where cyber - physical systems are widely used.
		3	Gain a knowledge Ability to use and develop robotics algorithms and cyber physical systems

  
**Dr. M. SUMAN**  
Professor & Head  
Department of ECE  
K L E F  
Green Fields, Vaddeswaram.  
Guntur Dist., A.P. PIN: 522 502

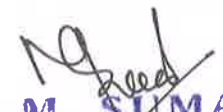
		4	Creates wider design analysis on RCPS and fabricate engineering systems that interact with humans and the environment and create sustainable solutions
		5	Design of various cyber physical systems by using Matlab
23RA5102	IIOE 4.0 FOR AUTOMATION AND ROBOTIC SYSTEMS	1	Understand the concepts, principles, and components of the Industrial Internet of Things
		2	Understand the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits
		3	Understand, design, and develop the real life IoT applications using off the shelf hardware and software
		4	Apply the concepts of Design Thinking to build various IIOE systems
		5	Design of various automation and robotic systems by using Matlab
23RA5103	ALGORITHMS FOR ROBOTICS SENSOR FUSION	1	Understand the sensor fusion principles, including sensor types, data fusion techniques, and fusion architectures commonly used in robotics
		2	Preprocessing sensor data and calibrating sensors to ensure accurate and reliable measurements, considering factors such as noise, bias, and sensor drift.
		3	Implementing sensor fusion algorithms on embedded systems or robotic platforms, considering constraints such as computational resources, latency, and power consumption.
		4	Evaluate the performance of sensor fusion algorithms through

  
**Dr. M. SUMAN**  
 Professor & Head  
 Department of ECE  
**KLEF**  
 Green Fields, Vaddeswaram,  
 Guntur Dist., A.P. PIN- 522 507


			simulation, experimentation, and quantitative analysis, considering metrics such as accuracy, robustness, and computational efficiency	
		5	Design of various robotic sensor systems by using Matlab	
23RA5104	ADVANCED WIRELESS NETWORKS	ROBOTIC SENSOR	1	Understand the concepts, principles, and components of RWSNs, including sensor nodes, communication protocols, energy management, and network topologies
			2	Apply the knowledge in RWSNs to improve the advances in Robotic Kinematics.
			3	Examining the Varieties of Robots & Advanced Robotics Heterogeneity (ARH)
			4	Integrate RWSNs with robotic systems, including unmanned aerial vehicles (UAVs), autonomous ground vehicles (AGVs), mobile robots, and robotic manipulators, to enable enhanced perception, communication, and coordination capabilities.
			5	Experiment and design wireless sensor networks by and analyse the performance
23IE5149	Term Paper	1	The term paper has to be taken up by the MTech Second Semester students. It is based on independent research in one of the areas opted by the student. In a term paper, a student should demonstrate his/her ability in finding out the relevant sources, selection, an illustration of logic, and in organizing the information on the topic, gathering the data, processing, analyzing, and summarizing.	

  
**Dr. M. SUMAN**  
 Professor & Head  
 Department of ECE  
**K L E F**  
 Green Fields, Vaddeswaran.  
 Guntur Dist., A.P. PIN: 522 507

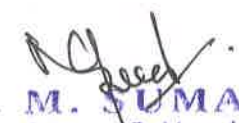
23UC5202	OBJECT ORIENTED PROGRAMMING	1	Understand the core principles of OOP, including encapsulation, inheritance, polymorphism, and abstraction
		2	Design and implement classes and objects to model real-world entities or abstract concepts effectively.
		3	Apply various types of class relationships such as inheritance, composition, and aggregation
23RA5105	AUTONOMOUS MOBILE ROBOTS AND AUTOMOTIVE ELECTRONICS	1	Knowledge explore on Robot locomotion, and Types of locomotion, uncharted territories in the Universe.
		2	Design of mobile robot kinematics and dynamics, holonomic and nonholonomic constraints.
		3	Development of passive/active sensors and mobile robots like global positioning system.
		4	Apply and analysis of path planning algorithms based on A -star, Dijkstra
		5	Experiment and design autonomous mobile robots systems
23EC5101	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	1	Understand the concepts of Artificial Intelligence and machine learning, including supervised learning, unsupervised learning, reinforcement learning, and neural networks
		2	Apply the concepts of neural networks for robotics applications
		3	Apply supervised learning algorithms to solve classification and regression problems in various domains, including image recognition, natural language processing, recommendation systems, and predictive analytics

  
**Dr. M. SUMAN**  
 Professor & Head  
 Department of ECE  
**K L E F**  
 Green Fields, Vaddeswaran-  
 Buntur Dist., A.P. PIN: 522 502


		4	Evaluating and validating machine learning models, including cross-validation, metrics such as accuracy, precision, recall, F1-score, and techniques for handling overfitting and underfitting
		5	Experiment and design AI models on multiple datasets by providing discriminative analysis of the evaluation metrics.
23RA5301	ROBOTICS: DESIGN OF SENSORS, DRIVES AND ACTUATORS	1	Acquire knowledge about the fundamental principles, Robot Sensors, and implementation strategies of Internal Sensors and Inertial Sensors.
		2	Design solutions for Ultrasonic Sensors in Home, industry, Vision, Stereo Vision, and Proximity Sensors.
		3	Integrate sensors effectively into robotic systems to enable perception, localization, mapping, and environmental monitoring capabilities, enhancing the autonomy and functionality of the robots.
		4	Synchronizing and coordinating multiple actuators and drives in robotic systems, enabling tasks such as coordinated motion, manipulation, and locomotion in multi-DOF robots.
		5	Experiments on simple robots using sensors and actuators
23RA5302	AUTONOMOUS MOBILE ROBOT SYSTEMS	1	Understand the basics of Autonomous Mobile Robots dynamics and design electronics to complement those features.
		2	Apply the suitable mobile robot kinematics and dynamics, Motion Control for effective autonomous system design

  
**Dr. M. SUMAN**  
 Professor & Head  
 Department of ECE  
**K L E F**  
 Green Fields, Vaddeswaran  
 Guntur Dist., A.P. PIN: 522 502

		3	Integrate perception systems with control algorithms in autonomous mobile robot systems to enable real-time decision-making and adaptive behavior in dynamic environments
		4	Deploying and testing autonomous mobile robot systems in simulation environments
		5	Design and Analyze the various autonomous mobile robot systems
23RA5401	HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE	1	Understanding the basics of HMI: Asimov's Laws, GUI Design, Aesthetics, Developments in Bio - Chips, Heuristics.
		2	Apply the HMI Technologies such as GMOS Models, CMN -GOMS, Fitts Laws, Hick - Hyman Laws, Norman's 7 Principles for building effective HMI systems
		3	Understanding the concept of Brainwaves & BMI
		4	Analyzing Humanoids & HMI/BMI Applications: Hierarchical Task] Analysis, Dialog Design, Use of FEM
		5	Design and analyse the interface between human and machine
23RA5402	COMPUTER VISION & APPLICATIONS	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.
		5	Design and analyse the inputs from visual sensors for various robotic

  
**Dr. M. SUMAN**  
 Professor & Head  
 Department of ECE  
**K J S O U**  
 Green Fields, Maddeswaran,  
 Guntur Dist., A.P. PIN: 522 507

			applications
23RA5501	SWARM ROBOTICS CONTROL SYSTEMS	1	Understand the principles and various Swam Robotics Control Systems
		2	Knowledge explore on multi -agent systems, Parallel, Scalable, Stable.
		3	Design of Swarm Robotics Control Systems and Creating advanced behavior module
		4	Analyze and Evaluate the Co-operative algorithms, earlier progress of swarm robotic algorithms and features of swarm robotics algorithm
23RA5502	SIGNAL PROCESSING FOR ROBOTICS	1	Basics classification of signals & types Characterization, typical Signal Processing operations
		2	Construction of manipulators, advantages and disadvantages of various kinematic structures. Applications
		3	Design Feedback systems, encoders Kinematics, 3 homogeneous coordinate solution of the inverse kinematic problem
		4	Apply and analysis Programming Language: Mobile robots, walking devices. Robot reasoning
23RA5601	AUTOMOTIVE ELECTRONICS & AVIONICS	1	Understand the fundamentals of comprehensive knowledge on automotive electronics.
		2	Explore and conjugate the emerging technologies utilized to assist the Autonomous Vehicles.
		3	Communication and Navigation of automated vehicle using vehicle intelligence
		4	Acquire the knowledge on aviation technology.
23RA5602	DESIGN OF AUTOMATION SYSTEMS	1	Acquire knowledge about the fundamental principles, hierarchy level, architecture, functions, and

  
**DR. M. SUMAN**  
 Professor & Head  
 Department of ECE  
**K J S O**  
 Green Fields, Maddeswaram  
 Guntur Dist., A.P. PIN: 522 502

	AND ASSISTIVE ROBOTIC SYSTEMS		implementation strategies of Distribution Automation Systems (DAS) and Distribution Management Systems (DMS).
		2	Provide solutions for Automation in Home, industry, Advanced Research Laboratories
		3	Understanding industrial robots and robotics arms, cooperative robotics arms, automated kitchen, studying about various home automation.
		4	Study of the robot assistive technology; understanding the Human Activity Assistive Technology (HAAT) model. Understanding of the Assistive Robotic Manipulators (ARM) Justify the use of robots in rehabilitation. Discuss the current international safety standards for robotic assistive technologies.



Academic Professor I/C



**Dr. M. SUMAN**  
 Professor & Head  
 Department of ECE  
 KLEF  
 Green Fields, Vaddeswaram  
 Guntur Dist., A.P. PIN: 522 502