Department of ECE
M. Tech ROBOTICS AND AUTOMATIONS
Description of Course Outcomes
2021-2023

S.NO	COURSE CODE	COURSE NAME	Cos	COURSE OUTCOME
1		Non-linear systems and control optimization for robotics	1	To introduce the need and concept of nonlinear system and optimizations for robotics
			2	To impart knowledge about different strategies adopted in the analysis 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	To familiarize with the design of different types of nonlinear Robotics controllers
2		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

			4	Creates wider design analysis on RCPS and fabricate engineering systems that interact with humans and the environment and create sustainable solutions
3		IIoE 5.0 for Automation and Robotic systems	1	Describe IOT,IIOT
			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 shelfhardware and software
			4	Understand the concepts of Design Thinking
4		Artificial intelligence & Machine learning	1	To understand the concepts of Artificial Intelligence
			2	To understand the concepts of neural networks
			3	To elaborate machine learning methods
			4	To understand the concepts of Fuzzy logic
1		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	Provide solutions for Ultrasonic Sensors in Home, industry, Vision, Stereo Vision, and Proximity Sensors
			3	Understanding Robot Actuators and Industrial Robots, cooperative robotics Electrical actuators, automated kitchen, studying about various home automation.
			4	Fundamentals of Motors, DC Motors; understanding Functionality of the Harmonic Drive Justify the use of robots in DC and AC servo drives for axis motors

2		Autonomous mobile Robot systems	1	Understand the basics of Autonomous Mobile Robots dynamics and design electronics to complement those features.
			2	Understand Mobile robot kinematics and dynamics, Motion Control
			3	Examining the autonomous mobile robot Perceptions with algorithms.
			4	Design studies on embedded to Automotive Electronics protocols vehicle testing, vibration.
3		Swam 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 concepts of Swam Robotics Control Systems and Creating Advanced behavior module.
			4	Analyze and Evaluate the Cooperative algorithms, earlier progress of swarm robotics algorithms, Features of swarm robotics algorithm
1		Automated Dynamic Analysis of MEMS sensors & actuators	1	Fundamentals of Micro and nano mechanics, Piezo Resistive Pressure sensors.
			2	Design of Actuators and calibration of different sensors
			3	Apply and analysis Optical encoder and tactile and proximity
			4	Apply and analysis Electro-pneumatic actuator, Electrical actuating systems and Piezoelectric actuator.
2		Human Machine Interface & Brain Machine Interface	1	Understanding the basics of HMI: Asimov's Laws, GUI Design, Aesthetics, Developments inBio-Chips, Heuristics.
			2	Understanding the HMI Technologies such as GMOS Models, CMN-GOMS, Fitts Laws, Hick-Hyman Laws, Norman's 7 Principles.

			3	Understanding the concept of Brainwaves & BMI
			4	Analyzing Humanoids & HMI/BMI Applications: Hierarchical Task] Analysis, Dialog Design, Use of FEM
3		Computer Vision & Application	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.
4		LiDAR & RADAR System Control	1	Understand the Principles and design concepts of various LiDARSystems and control Mechanisms.
			2	Study and analysis LiDAR Beam Steering and Optics System
			3	Analyze an existing radar system, synthesize the information, and explain to an audienceto establish the principle working CW radar, FM-CW radar
			4	Creating strong knowledge on algorithm for design radarsin various autonomy control
7		SEMINAR		Enhancing verbal delivery, body language, power point skills, structuring the presentation, engaging audience, tone of presentation for the overall improvement of individual presentation skills.

8		TECHNICAL SKILLING - I		Enhancing the system design and modeling capabilities through visualization of scientific theories and concepts while building and developing the capabilities of designing a new system by altering and implementing new algorithm and methods through visualization tools.
1		Advanced Robotic Wireless Sensor Networks	1	To know the Basic Robots Advancements and terminologies
			2	To impart knowledge in Advances in Robotic Kinematics
			3	Examining the Varieties of Robots & Advanced Robotics Heterogeneity (ARH)
			4	Understanding the Robotic Wireless Sensor Networks and Design project on various robots
2		Algorithms for Robotics Sensor Fusion	1	To expose the students to the concepts and techniques used in sensor data fusion
			2	To impart skills needed to develop and apply data fusion algorithms
			3	To expose the students, the state of the art in multi sensor/ source integration, target tracking and identification
			4	Gain a knowledge onsensor fusion algorithms with autonomous robots
3		Microelectromechanical Sensors and Actuators for Robotics	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 for robotics
			4	Gain a knowledge of basic approaches for various actuator design for robotics

4		Autonomous mobile robots and Automotive Electronics Systems	1	Knowledge explore on Robot locomotion, and Types of locomotion, unchartered 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
1		Adaptive motion control systems for automation and robotics	1	Understand the Principles and design concepts of various adaptive control Mechanisms.
			2	Understand the Principles and design concepts of Autonomous Tracked Robots
			3	Understand the Principles and design concepts of Motion Vision and Motion estimation
			4	Understand the Principles and design of Optimization for Motion Control Systems
2		FPGA-Based Wireless System Design	1	Software Defined Radio (SDR)
			2	Analysis of FPGA Speed, Area & Power
			3	Advanced Encryption Standards & High-Level Design
			4	FPGA for Wireless System
3		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, homogeneous coordinate solution of the inverse kinematic problem.
			4	Apply and analysis Programming Language: Mobile robots, walking devices. Robot reasoning.

4		Cloud Robotics and Automation	1	Automation principles and strategies, Methods of Work part Transport.
			2	Control Functions, Automation for Machining Operations and Assembly Systems and Line Balancing.
			3	Storage System Performance, Automated Storage/Retrieval Systems, Carouse
			4	Sensor Technologies for Automated Inspection and Analytical Models.
1		Optimization algorithms for autonomous systems	1	Develop 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 Algorithmsfitness functions.
			4	Apply and analysis of advanced autonomous optimization techniques.
2		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 basic knowledge on aviation technology.
3		Design of automation systems and Assistive Robotic systems	1	Acquire knowledge about the fundamental principles, hierarchy level, architecture, functions, and 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.
4		TERM PAPER	1	Enhancing the skill sets in research by recognize and identifying problems, exploring/defining the problem by gathering information, formulation of the research objectives, addressing the problem through scientific process and methods.
5		TECHNICAL SKILLING-II	1	Enhancing the system design and modeling capabilities through visualization of scientific theories and concepts while building and developing the capabilities of designing a new system by altering and implementing new algorithm and methods through visualization tools.