

M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054



**RAMAIAH
UNIVERSITY**
OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: M.Tech. in Robotic Engineering

Programme Code: 074

Programme Outcome (PO)

Programme Specific Outcome (PSO)

Program Educational Objectives (PEO)

Course Outcomes (CO)

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Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Registrar
M.S. Ramaiah University of Applied Science
Bangalore - 560 054

Faculty of Engineering and Technology (FET)

Programme Name: M.Tech. (Robotic Engineering)

Programme Outcomes (POs)

M.Tech. graduates will be able to:

- PO 1. Discuss the importance of robots in various applications
- PO 2. Design, develop geometric models of robots and perform kinematic and dynamic analysis
- PO 3. Select sensors, actuators, drives, end effectors and control systems for robots based on application
- PO 4. Develop on board real-time decision making capabilities in robots through image and signal processing
- PO 5. Design, develop and simulate robotic systems to meet varied functional and operational Requirements
- PO 6. Develop a career in Robotics and Automation
- PO 7. Practice Teamwork, lifelong learning and continuous improvement

Programme Specific Outcomes (PSOs)

The programme specific outcomes are listed under four headings:

1. Knowledge and Understanding
2. Cognitive skills
3. Practical skills and
4. Capability/Transferable skills

Knowledge and Understanding: After undergoing this programme, a student will be able to:

- PSO1: Explain the design and working of robotic systems, principles of sensors and its use in controlling robotic motion
- PSO2: Infer robotic system requirement for an application
- PSO3: Explain the kinematics and dynamics of robots and their effect
- PSO4: Discuss significance of sensors, actuators, end effectors, drives and control systems, image processing algorithms in robot design

Cognitive Skills: After undergoing this programme, a student will be able to:

- PSO5: Plan and arrive at conceptual configuration of a robot system for a given set of functional requirements
- PSO6: Develop an image processing flow diagram and appropriate algorithms for robotic system hardware platform for a specific application
- PSO7: Design, model and simulate appropriate control systems for robotic operation
- PSO8: Synthesise spatial mechanism for a robot to the defined application

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Practical Skills: After undergoing this programme, a student will be able to:

PSO9: Create virtual models and analyse robotic systems

PSO10: Use commercially available tools for modelling, simulation and analysis of robot mechanisms and controls

PSO11: Develop program for robotic systems

PSO12: Build robot using subsystems

Capability Skills / Transferrable Skills: After undergoing the programme, a student will be able to:

PSO13: Manage information, develop technical reports and make presentations

PSO14: Build, Manage and Lead a team to successfully complete a project and communicate across teams and organizations to achieve professional objectives

PSO15: Work under various constraints to meet project targets

PSO16: Adopt to the chosen profession by continuously upgrading his/her knowledge and understanding through Life-long Learning philosophy.

Course Outcomes (COs)

Course Title & Code: Computer Aided Design and Engineering (19MME501A)

After the successful completion of this course, the student will be able to:

- CO-1.** Specify and evaluate tools and techniques of CAE and their role in product development cycle
- CO-2.** Create geometric models and generate manufacturing drawings of engineering components
- CO-3.** Create rapid prototype model of a reverse engineered engineering component
- CO-4.** Develop finite element model for different types of analysis using Hyper-Mesh software
- CO-5.** Perform discretisation and engineering analysis using geometric modelling tools like CATIA and ANSYS software

Course Outcomes (COs)

Course Title & Code: Robotic Systems and Applications (19RBC501A)

After the successful completion of this course, the student will be able to:

- CO-1.** Discuss the evolution and future of robotic systems and applications
- CO-2.** Develop general idea of robot technology
- CO-3.** Analyse the anatomy of given robotic system
- CO-4.** Recognise the scope of robots in various applications
- CO-5.** Select robotic solutions for varied domains


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Course Outcomes (COs)

Course Title & Code: Robot Kinematics and Dynamics (19RBC502A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss basics of planar and spatial description, transformation, kinematics, dynamics and their importance in robotics
- CO-2. Apply D-H parameters for any robotic system
- CO-3. Perform forward and inverse kinematics on a manipulator
- CO-4. Evaluate forces and torque required to operate manipulators
- CO-5. Simulate kinematic and dynamic behaviour of robots using appropriate software tools

Course Outcomes (COs)

Course Title & Code: Mechatronics-I (19RBC503A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss the theory of analog, digital and mixed signal circuits
- CO-2. Evaluate and analyse the stability performance of feedback amplifiers
- CO-3. Identify and select the appropriate Op-amp for the design of signal conditioning circuits
- CO-4. Apply mixed signal concepts in development of data converters
- CO-5. Apply microcontroller concepts to interface sensors and actuators
- CO-6. Design, integrate and demonstrate working of a mechatronic system for a robot

Course Outcomes (COs)

Course Title & Code: Mechatronics-II (19RBC504A)

After the successful completion of this course, the student will be able to:

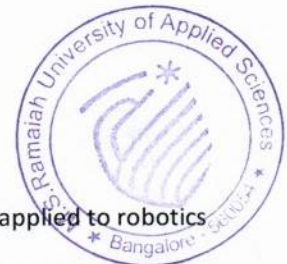
- CO-1. Discuss various mechanical, hydraulic and pneumatic control devices as applied to robotics
- CO-2. Analyze the robotic application for selecting appropriate end effector
- CO-3. Evaluate various mechanical, hydraulic and pneumatic component options and select the appropriate component for a robotic application
- CO-4. Design control circuit for robotic motion control and identify appropriate drive system
- CO-5. Create a drives circuit to achieve desired robot motion and to meet the specifications
- CO-6. Model and simulate hydraulic and pneumatic circuits using software for a robotic application

Course Outcomes (COs)

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- CO-5. Create a drives circuit to achieve desired robot motion and to meet the specifications
- CO-6. Model and simulate hydraulic and pneumatic circuits using software for a robotic application

Course Outcomes (COs)

Course Title & Code: Research methodology and IPR (19FET508A)

After the successful completion of this course, the student will be able to:

- CO-1. Explicate the value, scope, relevance and mandatory steps of research as well as principles of effective research, Nature of Intellectual Property
- CO-2. Discuss the guidelines to progress from the choice of broad field of research to specific topic of research, patent rights, process of patenting at National and International level, New Developments in IPR
- CO-3. Demonstrate the application and utility of the Systematic approach and out of box thinking concepts for research to be effective
- CO-4. Adapt ,Analyze and prepare well-structured research proposal and research paper invoking clearly outlined principles

Course Outcomes (COs)

Course Title & Code: Professional Communication (19FET509A)

After the successful completion of this course, the student will be able to:

- CO-1. Compose effective written business communication
- CO-2. Practice the techniques of presentation

Course Outcomes (COs)

Course Title & Code: Control Systems for Robots (19RBC505A)

After the successful completion of this course, the student will be able to:

- CO-1. Develop mathematical models of various subsystems of a control system
- CO-2. Perform time response and frequency response analysis of robotic control system models
- CO-3. Design a controller to meet error, stability and relative stability specifications
- CO-4. Suggest suitable drives and control circuits for developing a physical control system
- CO-5. Model and simulate linear, nonlinear and adaptive controller for a robotic system using software tools and analyze time response, steady state error and stability of the system

Course Outcomes (COs)

Course Title & Code: Image Processing for Robotics (19RBE511A)

After the successful completion of this course, the student will be able to:

- CO-1. Explicate the utility of vision as a sensor for robots and evaluate the challenges inherent in visual information
- CO-2. Discuss the underlying principles of common image processing techniques and their




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- CO-3. Analyze the mathematical and geometric principles underlying the formation of images
 - CO-4. Evaluate and analyze appropriate image processing algorithms for a specific application
 - CO-5. Model, simulate and analyze image processing and feature extraction algorithms for robotic applications using software

Course Outcomes (COs)

Course Title & Code: Industrial Robotics and Automation (19RBE521A)

After the successful completion of this course, the student will be able to:

- CO-1. Explicate the role of robotics and automation in industrial applications
- CO-2. Compile the technical and economical requirements of robotic automation
- CO-3. Develop robotic cell for give industrial applications
- CO-4. Conduct feasibility study for robotic projects
- CO-5. Compare the competing robotic solutions

Course Outcomes (COs)

Course Title & Code: Embedded Systems and Programming for Robots (19RBE512A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss the theory of embedded system organization, peripheral and peripheral interfacing and RTOS
- CO-2. Develop algorithms for robot control applications
- CO-3. Apply developed algorithms on a microcontroller interfaced with sensor and peripherals
- CO-4. Build programs using robotic programming high level languages to control robotic operations
- CO-5. Demonstrate various kinematic actions of a robot using programs

Course Outcomes (COs)

Course Title & Code: Computer Vision (19RBE522A)

After the successful completion of this course, the student will be able to:

- CO-1. Explicate basic concepts, terminology, theories, models and methods in computer vision
- CO-2. Discuss basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition and analysis
- CO-3. Apply mathematical modelling methods for low-, intermediate- and high-level image processing tasks
- CO-4. Recommend a design of a computer vision system for a specific problem
- CO-5. Design new algorithms to solve computer vision problems and compare their performance with the state-of-the-art
- CO-6. Develop computer vision applications

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Course Outcomes (COs)

Course Title & Code: Machine Learning and Applications (19RBE513A)

After the successful completion of this course, the student will be able to:

- CO-1. Explicate the concepts of artificial intelligence and intelligent agents
- CO-2. Discuss the principles of knowledge representation, search strategies, learning, reasoning and planning
- CO-3. Apply the principles of knowledge representation, search strategies, learning, reasoning and planning to design intelligent agents
- CO-4. Analyze a scenario and identify strategies for knowledge representation, search, learning, reasoning and planning
- CO-5. Synthesize an intelligent agent for a given scenario
- CO-6. Evaluate the performance of an intelligent agent based on appropriate measures of performance

Course Outcomes (COs)

Course Title & Code: Design of End Effectors (19RBE523A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss classification, requirements, characteristics and selection of grippers
- CO-2. Analyse kinematic characteristics of grasping
- CO-3. Develop model of grasp to analyse stiffness, strength and stability of grasp
- CO-4. Assess given grasping arrangement through qualitative and quantitative evaluation
- CO-5. Propose hand and wrist design for a given manufacturing application

Course Outcomes (COs)

Course Title & Code: Robot System Design and Development (19RBE514A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss the functionality of various systems/subsystems/elements of a robot
- CO-2. Appraise design philosophies adopted for the development of a robot for a given application
- CO-3. Develop specifications for a particular robot application
- CO-4. Select all required subsystem and components for a robotic application
- CO-5. Create robot integration and validate using simulation software

Course Outcomes (COs)

Course Title & Code: Value Education (19FET510A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss the role of Values and Ethics in Self-Development
- CO-2. Appreciate the importance of Universal Brotherhood

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Course Outcomes (COs)

Course Title & Code: Internship (19RBP521A)

After the successful completion of this course, the student will be able to:

- CO-1. N/A

Course Outcomes (COs)

Course Title & Code: Group Project (19RBP522A)

After the successful completion of this course, the student will be able to:

- CO-1. Work in a team and undertake a project in their area of specialization
- CO-2. Apply their knowledge of general and automotive engineering and application, develop a system for automotive application
- CO-3. Apply appropriate research methodology while formulating a project
- CO-4. Prepare specifications, design, analyse, synthesize, prototype and assess the system
- CO-5. Prepare and present appropriate forms of audio-visual and verbal presentations, and written document, to describe the project, its execution and outcome

Course Outcomes (COs)

Course Title & Code: Dissertation and Publication (19RBP523A)

After the successful completion of this course, the student will be able to:

- CO-1. Critically review scholarly literature collected from various sources for the project purpose and formulate a research
- CO-2. Prepare and present a research proposal
- CO-3. Conduct research to achieve research objectives
- CO-4. Propose new ideas/methodologies or procedures for further improvement of the research undertaken
- CO-5. Create research document and write research papers for publications
- CO-6. Defend the research findings in front of scholarly audience



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