



MARATHA VIDYA PRASARAK SAMAJ'S

**Karmaveer Adv. Baburao Ganpatrao Thakare
College of Engineering, Nashik**



Permanently Affiliated to Savitribai Phule Pune University Vide Letter No. : CA/1542 & Approved by AICTE New Delhi - Vide Letter No. : 740-69-32 (E) ET/98 AISHE Code - C-41622

Instrumentation & Control Engineering Department

Vision

To be an accredited department of preferred choice among common masses in the multidisciplinary field of automation and control engineering.

Mission

- M1. To prepare competent professionals to meet current and future demands of industry, academia and society of multidisciplinary field of automation.
- M2. To strengthen collaboration with reputed industries and institute of global insight.
- M3. To inculcate spirit of research and entrepreneurship amongst the students.

Program Educational Objectives

- To build core competency in the multidisciplinary field of automation to cater the industry and research needs.
- Develop multi-disciplinary skills, team spirit and leadership qualities with ethics, to excel in professional career and higher studies in Instrumentation and Control Engineering.
- To learn and apply contemporary technologies for addressing impending challenges for the benefit of organizations and society.

Program Outcomes

PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes

PSO1	Students will have a strong foundation in mathematical, scientific, engineering, and management fundamentals necessary to formulate, solve & analyze complex instrumentation problems.
PSO2	Apply instrumentation & control in multidisciplinary domains related to research & entrepreneurship development.
PSO3	Communicate effectively to work as a team with professional ethics for the benefit for society.

Course Outcomes For 2019 Pattern

SE Semester-I

Course Code	Engineering Mathematics-III (207008)
C201.1	Solve higher order linear differential equation and illustrate mathematical model on simple electrical circuit and control system.
C201.2	Apply Laplace Transform to solve problems related to signal processing and control systems.
C201.3	Solve basic problems involving Fourier Transform, Z-Transform and illustrate their applications.
C201.4	Apply statistical methods like correlation, regression and probability theory as applicable to analyze and interpret experimental data related to energy management, power system, testing and quality control.
C201.5	Perform vector differentiation & vector integration, analyze the vector field and apply to electro-magnetic fields and wave theory.
C201.6	Analyze conformal mappings, transformations and perform contour integration of complex functions

Course Code	Sensor & Transducers (206261)
C202.1	Demonstrate displacement, velocity sensors and transducers.
C202.2	Demonstrate force and torque sensors and transducers.
C202.3	Use pressure sensors and transducers for given measurement.
C202.4	Select temperature sensors for a given application.
C202.5	Select flow sensor for the given fluid flow measurement.
C202.6	Demonstrate miscellaneous sensors according to their working principles.

Course Code	Linear Integrated Circuits (206262)
C203.1	Illustrate significance of operational amplifier characteristics.
C203.2	Analyze closed loop configurations of operational amplifier.
C203.3	Analyze the performance of linear applications using operational amplifier.
C203.4	Analyze the performance of non-linear applications using operational amplifier.
C203.5	Design timer using IC555 and special purpose integrated circuits.
C203.6	Analyze active filter circuit performance.

Course Code	Electrical Measurements and Instrumentation(206263)
C204.1	Apply the fundamentals of instrumentation in measurements and calibration of instruments.
C204.2	Demonstrate extension of ammeter and voltmeter measurement range.
C204.3	Illustrate electrical parameters measurement with the help of oscilloscopes.
C204.4	Calculate the unknown resistance and capacitance for the given bridge circuits.
C204.5	Demonstrate ADCs and DACs working used in digital measuring instruments.
C204.6	Make use of recorder and function generator.

Course Code	Control System Components (206264)
C204.1	Demonstrate the working of switches, relays and contactors for controlling single/three phase motors.
C204.2	Develop electrical circuits for motor forward, reverse, jogging, inching operation.
C204.3	Develop pneumatic circuits using 2,3,5 way pneumatic valves, motor and cylinders.
C204.4	Develop hydraulic circuit using 2,3 5 way hydraulic valves, motor /cylinders.
C204.5	Differentiate between SCR,UJT,TRIAC,DIAC,MOSFET and IGBT
C205.6	Explain the function of auxiliary components (synchros, alarm annunciator, square root extractor, flow totalizer) and hazardous area classification as per NEC standards

Course Code	Computational Techniques (206265)
C206.1	Practice with MATLAB environment.
C206.2	Develop MATLAB program for mathematical problem.
C206.3	Import and Export data using MATLAB
C206.4	Develop Simulink model of system.
C206.5	Design GUI model for specific applications

Course Code	Communication Skills (206266)
C207.1	Use of SWOT analysis to realize oneself and set personal and career goals (short term, long term).
C207.2	Develop verbal and non-verbal communication skills using IT tools.
C207.3	Develop Listening skill, participate in group discussions, interpret the subject, comment and summarize .
C207.4	Build their resume effectively referring latest online websites.
C207.5	Minimize work stress effectively using different techniques
C207.6	Develop leadership qualities and function effectively in a team.

Course Code	Audit Course (Road Safety) III (206267)
C208.1	Understand the health, legal and safety related issues of society.
C208.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C208.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.

SE Semester-II

Course Code	Control Systems (206268)
C209.1	Classify the control systems
C209.2	Apply the ordinary differential equation to obtain the transfer function of electrical and mechanical systems
C209.3	Illustrate the Signal Flow Graph and Block Diagram techniques to determine the transfer function of the system
C209.4	Analyse the transient and steady state response of first and second order system
C209.5	Test the stability of the control system using routh-hurwitz criterion and Root locus.
C209.6	Draw the bode plot to test the stability of first and second order control system in frequency domain

Course Code	Digital Electronics (206269)
C204.1	Perform arithmetic operations, code conversion using number systems and verify the logic gates using truth-tables.
C204.2	Simplify logical expressions using Boolean Laws, K-map method and design them using logic gates.
C204.3	Design combinational digital circuits using logic gates
C204.4	Demonstrate sequential logic circuits used in shift registers and counters.
C204.5	Design synchronous, asynchronous sequential and non- sequential counters.
C204.6	Articulate logic family characteristics and Implement Boolean functions using programmable logic array.

Course Code	Process Loop Elements (206270)
C211.1	Determine the control objectives, input-output variables for process control loops.
C211.2	Demonstrate transmitters and converters for flow and level measurements.
C211.3	Determine the response of discontinuous and continuous (P, I, D, PI, PD and PID) control actions for standard input signals
C211.4	Determine the PID controller parameters by using tuning methods: process reaction curve, Ziegler-Nichols and frequency response method for a given process.
C211.5	Analyze characteristics of control valve.
C211.6	Demonstrate the working of control valve accessories and actuators.

Course Code	Signals and Systems (206271)
C 212.1	Identify and represent the type of signals and systems and perform elementary operations on signals.
C 212.2	Classify systems based on their properties
C 212.3	Understand fundamental properties of LTI systems and be able to determine response of the system for given input.
C 212.4	Determine Fourier series and Fourier transform of Continuous time signals and understand how to interpret and plot Fourier transform magnitude and phase functions.
C 212.5	Analyse and design of an LTI systems using Fourier transform and Laplace transform.
C 212.6	Understand the concept of probability and statistical properties of signals.

Course Code	Data Structures (206272)
C213.1	Use arithmetic, logical and relational operators in Python.
C213.2	Apply conditional and looping constructs, functions in coding for Python language.
C213.3	Demonstrate operations of Arrays, Matrix and Lists using Python.
C213.4	Apply operations on Sets and Maps using Python.
C213.5	Demonstrate operations with linked lists in Python.
C213.6	Demonstrate various operations on Stacks and Queues in Python.

Course Code	Project Based Learning (206273)
C214.1	Identify projects relevant to Instrumentation and Control systems
C214.2	Use different electronic components and sensors/transducers to provide practical solution to real life problems.
C214.3	Design /model/simulate/and fabricate a prototype
C214.4	Demonstrate project which includes measurement of parameter, signal processing, controlling, debugging related to objectives defined in the problem statement.
C214.5	Inculcate long life learning attitude towards the Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects
C214.6	Prepare the documentation related to project.

Course Code	Audit Course (Ethics and Etiquettes) IV (206274)
C215.1	Understand the health, legal and safety related issues of society.
C215.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C215.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.

TE Semester-I

Subject Code	Embedded System Design (306261)
C301.1	Analyze the arithmetic and logical operations of 8051 micro-controller using assembly language programming.
C301.2	Analyze the timer/counter, interrupt & serial communication operations using assembly language programming.
C301.3	Develop assembly level or C programs using 8051 instructions set.
C301.4	Design interfacing of input-output analog and digital devices using 8051 microcontrollers.
C301.5	Design applications such as temperature controller, line tracing robot, washing machine using 8051 microcontroller/Arduino.
C301.6	Demonstrate basic architecture, characteristics, quality attributes and operating systems of embedded systems used in industry.

Subject Code	Industrial Automation-I (306262)
C302.1	Understand the fundamentals of Industrial Automation, PLC & SCADA
C302.2	Develop Ladder Program using basic & advanced PLC instructions for Sequential & Continuous processes.
C302.3	Interface Analog & Digital I/O devices, Hydraulic & Pneumatic systems and VFD with PLC.
C302.4	Apply Analog PLC functions to given process control applications.
C302.5	Develop SCADA system for given applications.

Subject Code	Modern Control Theory (306263)
C303.1	Construct the state space model of the linear time invariant control system.
C303.2	Analyze the homogeneous and non-homogeneous state equation of the second order system.
C303.3	Apply the concept of controllability, observability and various stability methods for the system in state space.
C303.4	Determine the state feedback controller, Full order state observer using Ackermann's formula, coefficient comparison method for given system.
C303.5	Realize the structure of the discrete time system.
C303.6	Test for the stability of the sample data control systems

Subject Code	Operating System (306264)
C304.1	Summarize the fundamentals of operating systems.
C304.2	Solve for the performance evaluation of process scheduling algorithms in operating systems.
C304.3	Apply memory management concepts.
C304.4	Analyze safety of operating system.
C304.5	Use the file system management concepts.
C304.6	Use techniques for protection and security of operating system.

Subject Code	Elective-I, Mechatronics & Robotics (306265)
C305A.1	To learn designing of mechanical devices that incorporate electrical, software and mechanical components.
C305A.2	To learn actuation techniques used in micro electro-mechanical systems
C305A.3	To analyze mechatronics systems
C305A.4	To analyze the applications of robots in various industries.
C305A.5	To analyze various robot structures and their workspace.
C305A.6	To analyze motion equations and transformations required to design a robot along with robot programming for advanced application.

Subject Code	Seminar (306266)
C306.1	Identify , understand and discuss current, real-world instrumentation and control issues from research literature.
C306.2	Distinguish and integrate multidisciplinary differing forms of knowledge in terms of data interpretation.
C306.3	To contemplate/create innovative idea and present it.
C306.4	Improve oral and written communication skills by creating report in Latex/equivalent editor.
C306.5	To elaborate/access use of modern engineering and IT tools including prediction and modeling with an understanding of the limitations relevant to professional engineering practice.
C306.6	Apply ethical principles and respect in interaction with others.

Subject Code	Audit Course-V (306267)
C307.1	Understand the health, legal and safety related issues of society.
C307.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C307.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.

TE Semester-II

Subject Code	Internet of Things (306268)
C308.1	Summarize the evolution of building blocks of IoT
C308.2	Compare the connectivity technologies and protocols in IOT.
C308.3	Use IoT platform for application development.
C308.4	Discuss resource management in IoT.
C308.5	Discuss security issues in IoT.
C308.6	Summarize the IoT application case studies.

Subject Code	Industrial Automation-II (306269)
C309.1	Understand the fundamentals of DCS Organization in Industrial Automation.
C309.2	Analyze the software and hardware DCS configuration.
C309.3	Analyze the latest networking technologies RS232, RS485, OPC, HART and Field bus protocol.
C309.4	Analyze the different security design approaches, engineering and operator interface issues for designing Distributed control system.
C309.5	Design and development of DCS programming for simple process applications.
C309.6	Apply DCS control for different applications

Subject Code	Digital Signal Processing (306270)
C310.1	Explain the characteristics of signals and systems.
C310.2	Analyze the discrete time systems using Linear Convolution, Correlation and Z-transform methods.
C310.3	Analyze the discrete time systems using Discrete Time Fourier Transform.
C310.4	Determine the DFT of the given sequence using radix-2 DIT and DIF algorithm
C310.5	Design Infinite Impulse Response (IIR) filters for given specifications.
C310.6	Design Finite Impulse Response (FIR) filters for given specifications.

Subject Code	Elective-II Building Automation (306271)
C311.1	Analyze instrumentation & control techniques to articulate the purpose and operation of HVAC system components and HVAC systems.
C311.2	Apply engineering fundamentals to find thermal comfort conditions with respect to temperature and humidity and human clothing and activities and its impact on human comfort, productivity, and health.
C311.3	Analyze the needs and requirements for ventilation and its impact on design and energy and its impact on human comfort, productivity, and health.
C311.4	Analyze the control techniques used in chilled water and hot water systems.
C311.5	Compare the way in which a large fire alarm system would be connected and zoned.
C311.6	Analyze the instrumentation & control techniques that make up an Access Control System.

Subject Code	Mini Project (306272)
C312.1	Identify, select and undertake mini-project work related to engineering.
C312.2	Explain the product development cycle.
C312.3	Plan and organize the mini project work.
C312.4	Execute the mini-project work with all constraints (time and cost).
C312.5	Develop hardware by learning PCB design, Soldering, testing and troubleshooting techniques.
C312.6	Demonstrate and document the mini project work.

Subject Code	Internship (306273)
C313.1	Develop professional competence through industry internship
C313.2	Apply academic knowledge in a personal and professional environment
C313.3	Build the professional network and expose students to future employees
C313.4	Apply professional and societal ethics in their day to day life
C313.5	Develop professional approach for social, economic, and administrative considerations

Subject Code	Audit Course-VI (306274)
C314.1	Understand the health, legal and safety related issues of society.
C314.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C314.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.

BE Semester-I

Subject Code	Process Control Techniques (406261)
C401.1	Estimate the input variables, output variables, constraints and characteristics of processes and determine control objectives.
C401.2	Derive, develop and analysis of a mathematical model using fundamental laws and by performing experiments on prototype systems.
C401.3	Design a PID controller using direct synthesis and IMC strategy for stable processes (either minimum or non-minimum phase). Tuning of PID controller using open loop process reaction curve method and closed loop ultimate cycle method.
C401.4	Design Cascade, Ratio, Feedforward, Selective, Split range and Inferential Control. Understand physical realization limitations due to time delays and RHP zeros.
C401.5	Determine the degree of interaction and proper input-output pairings that best suited for the control problem through the concept of relative gain array (RGA), and design a de-coupler controller

Subject Code	Project Engineering & Management (406262)
C402.1	Understand the role and responsibilities in the project organization team
C402.2	Use the tools of Project Planning and scheduling and planning
C402.3	Plan and prepare the documents/activities required during different phases of the project.
C402.4	Use the standards need to be used in the project development.
C402.5	Interpret the design information from the documents

Subject Code	Elective- III Wireless Sensor Networks (406263)
C403C.1	Design a wireless sensor network for given sensor data using microcontroller, transceiver, middleware and operating system.
C403C.2	Evaluate the performance of schedule based and random Medium Access Control protocols for power consumption, fairness, channel utilization and control packet overhead.
C403C.3	Evaluate the performance of Geographic routing protocols for power consumption, scalability and latency parameters.
C403C.4	Evaluate the performance of transport control protocols for congestion detection and avoidance, reliability and control packet overhead parameters.
C403C.5	Explore and implement solutions to real world problems using sensor devices, enumerating its principles of working.

Subject Code	Elective-IV Automotive Instrumentation (406264)
C404C.1	Design and implement measurements system in automobiles using various sensors and transducers.
C404C.2	Develop automated systems for safety of passengers and vehicles.
C404C.3	Implement different standards and protocols for automobile automation.
C404C.4	Identify designing required for electric vehicle charging.
C404C.5	Design and develop IoT automation for vehicle manoeuvrability and accident avoidance.

Subject Code	Virtual Instrumentation Lab (406265)
C405.1	Understanding Virtual Instrument concepts.
C405.2	Develop program for specific application using Virtual Instrument software.
C405.3	To acquire , analyze and display the throughput of any compatible system.
C405.4	Interface hardware and software using Virtual Instrument.

Subject Code	Project Stage- I (406266)
C406.1	Identify and Analyze the engineering project problems for industry and society.
C406.2	Utilize the technical knowledge and skills to outline the project work statement.
C406.3	Determine the Hardware and Software requirements to solve the project problem.

Subject Code	Audit Course-VII (406267)
C407.1	Understand the health , legal and safety related issues of society.
C407.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C407.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.

BE Semester-II

Subject Code	Process Instrumentation (406268)
C408.1	Discuss the basic operations of Heat Exchanger, Dryer, Evaporator, Boiler, Distillation column, Reactors, Pumps and Compressors and Determine the scaling equations for unit processes and operations.
C408.2	Analyze dynamics of of Heat Exchanger, Dryer, Evaporator, Boiler, Distillation column, Reactors, Pumps and Compressors. Identify process variables, control variables and an appropriate manipulated variables for their control and disturbance variables.
C408.3	Design an appropriate regulatory and servo controller (Feedback, Cascade and Feed forward) for Heat Exchanger, Dryer, Evaporator, Distillation column and Reactor to achieve desired performance.
C408.4	Design an appropriate regulatory and servo controller (Feedback, Cascade, Selective Split range, Anti-surge) for Boiler, Pumps and Compressors to achieve desired performance.
C408.5	Design/Develop , tuning, implementation and simulation of appropriate servo and regulatory controller for a given process using MATLAB Simulink and Estimate the performance measures. (Rise time, Settling time, Overshoot, Integral errors)

Subject Code	Advanced Embedded System (406269)
C409.1	Independently design and implement an advanced embedded system based on an 16/32-bit microcontroller.
C409.2	Develop software and hardware for embedded systems using ARM microcontroller.
C409.3	Design, structure and realize microcontroller systems with ARM
C409.4	Identify the functionality of development boards to implement ARM embedded applications.
C409.5	Design and develop real time ARM embedded systems used in industry.

Subject Code	Elective-V, Renewable Energy Systems (406270)
C410C.1	Understand the concept of distributed generation with renewable energy sources and know its main types
C410C.2	Know the operation and comparative analysis of different concentrating solar power systems.
C410C.3	Describe the complexities of energy systems and power grids, and the requirements and industrial impacts of integration, automation and optimization
C410C.4	Calculate the major parameters of sun movement, solar radiation, and tracking systems
C410C.5	Analyse the types of algorithms and understanding and familiarity with engineering and financial aspects of projects
C410C.6	Understand major concepts of wind energy. Calculate air parameters at different conditions, impact of installation height, wind power and average wind power
C410C.7	Design in order implement and improve a component, process, or integrated system of people, materials, information, equipment, and energy to meet desired needs within realistic constraints

Subject Code	Elective-VI, Environmental Instrumentation (406271)
C411C.1	Design instrumentation systems for environment monitoring.
C41CA.2	Develop methodology for waste water treatment.
C411C.3	Measure and analyse air quality and other parameters.
C411C.4	Measure and analyse water quality.
C411C.5	Provide solution to reduce pollution

Subject Code	Project Stage –II (406272)
C412.1	Organize and build the project within time and financial resources.
C412.2	Test and verify the implemented solution for the selected project problem.
C412.3	Demonstrate and document the project work.

Subject Code	Audit Course (406273)
C413.1	Understand the health, legal and safety related issues of society.
C413.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C413.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.