MARATHA VIDYA PRASARAK SAMAJ'S
KARMAVEER ADV. BABURAO GANPATRAO THAKARE
COLLEGE OF ENGINEERING
KBTCOE
www.kbtcoe.org
Permanently Affiliated to Savitribai Phule Pune University Vide Letter No: CA/1542
& Approved by AICTE New Delhi Vide Letter No: 740-89-32 (E) ET/98
AISHE Code - C-41622

Instrumentation & Control

Engineering Department

Course Outcomes

AY 2019-20

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

1. Core competency in the multidisciplinary field of automation to cater to the industry and research needs.
2. Multi-disciplinary skills, team spirit and leadership qualities with professional ethics, to excel in professional career and/or higher studies in Instrumentation and Control Engineering.
3. Prepared to learn and apply contemporary technologies for addressing impending challenges for the benefit of organization/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 analyze 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 modeling 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 life-long learning in the broadest context of technological change

Program Specific Outcomes

PSO 1	Students will have a strong foundation in mathematical, scientific & engineering fundamentals necessary to formulate, solve & analyze complex instrumentation problems.
PSO 2	Apply instrumentation & control in multidisciplinary domains related to research & entrepreneurship development. (Domains: Process, Biomedical, Environment, Power generation etc.)
PSO 3	Communicate effectively to work as a team with professional ethics for the benefit for society.

Course Outcomes
ACADEMIC YEAR:-2019-20
SE Semester-I

Subject Code	**Engineering Mathematics-III (207006)**
C201.1	Solve higher order linear differential equations.
C201.2	Compute Laplace transform and use it to solve differential equation by using laplace transform method.
C201.3	Solve problems related to Fourier transform, Z –Transform to solve difference equation.
C201.4	Use Vector differentiation to solve vector identities and directional derivatives, check irrotational and solenoidal vector fields.
C201.5	Apply Vector Integration to compute Line, surface and Volume Integrals.
C201.6	Use Complex differentiation to check analytic function and perform contour integration by using complex integration.

Subject Code	**Sensors & Transducers- I (206261)**
C202.1	Classify sensors, transducers and explain its characteristics.
C202.2	Demonstrate and select displacement sensors and transducers.
C202.3	Identify and choose suitable sensor for Velocity, Speed, Vibration and Acceleration measurement.
C202.4	Classify and Demonstrate torque/force sensors and transducers.
C202.5	Make use of pressure sensors and transducers.
C202.6	Classify, choose the temperature sensors. Use RTD, thermocouple, LM35 IC for temperature measurement.

Subject Code	**Basic Instrumentation (206262)**
C203.1	Apply the fundamentals of instrumentation in measurements and calibration of instruments.
C203.2	Make use of instrument with appropriate specifications and design of extension of range instrument.
C203.3	Experiment with different bridge circuits for unknown parameter (Resistance, Capacitance) measurement.
C203.4	Demonstrate the use of oscilloscopes for electrical parameter measurement.
C203.5	Select the digital instrument for the measurement of given parameter.
C203.6	Select and make use of recorder and function generator for the specified parameter.

Subject Code	Linear Integrated Circuits (206263)
C204.1	Students will be able to *illustrate* characteristics, *discuss* their significance in *selection* of operational amplifier (PO2 and PO5), also *compare open & closed loop configuration*.
C204.2	Students will be able to *design* and *implement* closed loop configurations of op-amp (PO1).
C204.3	Students will be able *formulate* simple problems for sensors using linear circuits (AD620), *communicate* effectively and understand importance of lifelong learning. (PO10, PO12)
C204.4	Students will be able to *design* and *analyze* non-linear applications.
C204.5	Students will be able to design and develop timers and linear voltage regulator.
C204.6	Students will be able to design and develop active filter.

Subject Code	Network Theory (206264)
C205.1	Solve electrical network problems using mesh current and node voltage equations.
C205.2	Apply Network Theorems for the analysis of DC Networks
C205.3	Evaluate the network functions for electrical networks.
C205.4	Determine Z, Y, H, ABCD parameters and their Interrelationship for two port Networks.
C205.5	Estimate R, L and C components of LC, RL and RC driving point functions by Foster and Cauer forms.
C205.6	Explain the design of constant K-Filters, T and π Attenuators.

Subject Code	Programming Languages (206265)
C206.1	Write a C Program for small applications.
C206.2	Apply proper searching and sorting methods for a given application.
C206.3	Implement the operation of stack and queue using arrays.
C206.4	Construct and test C program for matrix operations.
C206.5	Apply appropriate techniques using C language for solving the computing problems (polynomial addition and data base management).
C206.6	Will be able to write simple program in graphics.

Course Outcomes
ACADEMIC YEAR:-2019-19
SE Semester-II

Subject Code	**Sensors & Transducers- II (206267)**
C208.1	Demonstrate the flow measuring sensor (Orifice, Venturi, Rotameter).
C208.2	Experiment with the measurement of water level using air purge technique. Also identify and select suitable level sensor for the given application.
C208.3	Make use of Viscosity and/or Density measuring methods for the given liquids.
C208.4	Experiment with the miscellaneous sensors (pH sensors, Proximity sensors, Conductivity).
C208.5	Explain the importance of sensor signal conditioning devices.
C208.6	Design and develop signal conditioning circuit for given specifications using RTD, Thermocouple or other suitable transducer.

Subject Code	**Automatic Control Systems (206268)**
C209.1	Apply ordinary differential equation to obtain the transfer function of electrical and mechanical systems
C209.2	Illustrate the Signal Flow Graph and Block Diagram techniques to determine the transfer function of the system
C209.3	Analyse the transient and steady state response of first and second order system
C209.4	Determine the stability of the control system using routh-hurwitz criterion and Root locus.
C209.5	Examine the performance specification and stability of control system in frequency domain
C209.6	Develop the state-space model from transfer function of given system

Subject Code	**Electronic Instrumentation (206269)**
C210.1	Analyze the operation of different types of measuring instruments like True-RMS Meter,DMM, RLC-Q meter, Distortion Factor Meter, Universal Counter and know the working of measuring instruments.
C210.2	Analyze the operation of different types of signal generating instruments like Arbitrary Waveform Generator, Ramp wave Generator, Pulse Generator. Know the working of signal generating instruments
C210.3	Know the complete internal structure of ADCs and DACs. Perform the experiments
C210.4	In the LCR circuit student can determine experimentally the unknown inductance, capacitance and resistance and Q and D factor with the instruments with which he can know the different options and strengths of the instruments.
C210.5	Further to know the knowledge in the field of integrated circuit technology and its applications like PLL, VCO, Analog MUX/DEMUX, VTF and FTV.
C210.6	Understand and Analyze the types of modulations, Demonstrate about various blocks in Transmitters and Receivers, Analyse all Modulation techniques in time and frequency domains
C210.7	An ability to built, implement software programming using Labview to solve engineering problems

Subject Code	Digital Techniques (206270)
C211.1	Represent numerical values in various number systems and perform number conversions between different number systems
C211.2	To reduce the digital circuits by using Boolean algebra, K-maps and Tabulation Method. Also can interface the different components from different logic families.
C211.3	Design and implement the combinational circuits (Adder, Subtractor, decoders, encoders, multiplexers, and de-multiplexers).
C211.4	Understand basic concepts of flip-flops, registers and counters.
C211.5	Design, implement and analyze sequential circuits using flip-flops, registers and counters.
C211.6	Summarize memory devices: ROM, RAM, PROM, PLD, FPGAs. Also can design a simple application of digital system.

Subject Code	Industrial Drives (206271)
C212.1	To use different power electronics devices in various applications.
C212.2	To draw and analyze input/output waveforms of converters, choppers and inverters.
C212.3	To select DC motors for different applications.
C212.4	To select single phase AC motors for different applications.
C212.5	To choose suitable technique for controlling the DC motors.
C212.6	To choose suitable technique for controlling single phase AC motors.

Subject Code	Soft Skills (206271)
C213.1	Student will be able to apply Strength Weakness Opportunities and Threats (SWOT) analysis& set their own goals.
C213.2	Confidently speak and present their work in front of masses. Also can effectively write letters, applications and reports.
C213.3	Listening discussions interpret the subject and write minutes of meeting.
C213.4	Participate in group discussion and prepare their resume.
C213.5	Effectively manage work stress.
C213.6	Work in a team with good leadership qualities.

Subject Code	**Drives Control Laboratory (206273)**
C214.1	Perform programming in MATLAB M file and MATLAB SIMULINK software.
C214.2	Determine/Analyze the transient response parameters of 2^{nd} order transfer function of different systems.
C214.3	Analyze the stability of system using root locus and bode plot methods.
C214.4	Demonstrate the SCR characteristics.
C214.5	Make use of UJT for SCR triggering.
C214.6	Implement the controlled rectifier circuits to control speed and direction of dc motor.

Course Outcomes
ACADEMIC YEAR:-2019-19
TE Semester-I

Subject Code	**Embedded System Design (306261)**
C301.1	Acquire knowledge about microcontrollers, embedded Systems and their applications. Summarize the difference between microcontroller and microprocessor. Foster ability to understand the internal architecture of 8051 microcontroller along with programming 8051.
C301.2	Discuss the basic functions of timer counters and interrupts in human life. Understand the function of timer counter and interrupt blocks in 8051 microcontroller.
C301.3	Understand the interfacing of 8051 Microcontrollers with different peripheral devices like LED Displays, LCD displays, Keyboards, DAC & ADC.
C301.4	Able to interface 8051 Microcontrollers with Real world devices like Sensors, Stepper motor, Relays, RTC, Serial ADC and Serial EEPROM. Give examples to understand the role of embedded systems in industry.
C301.5	To understand the architectural details of AVR microcontroller. Summarize the comparison of AVR microcontroller and 8051 microcontroller. In association with instruction set foster ability to write the programs for AVR microcontroller.
C301.6	Discuss the different blocks like Timer/counter, UART & ADC of AVR microcontroller.

Subject Code	**Instrumental Methods for Chemical Analysis (306262)**
C302.1	Compare, Classify and Explain Instrumental and chemical methods for analysis of samples.
C302.2	Demonstrate the measurement of sample concentration using Colorimeter/UV Visible Spectrophotometer, Densitometer & Atomic Absorption Spectrophotometer.
C302.3	Demonstrate the measurement of sample concentration using Flame Photometer.
C302.4	Explain Fluorimeter, Phosphorimeter, Nuclear Magnetic Resonance spectrometry and gas analyzers.
C302.5	Analyze various samples (Toluene, acetone, benzene, sunflower oil) using Gas Chromatograph & HPLC.
C302.6	Interpret the use of X-ray Spectrometry and radiation detectors.

Subject Code	**Control System Components (306263)**
C303.1	Demonstrate the working of switches, relays and contactors for controlling single/three phase motors.
C303.2	Design, Develop and demonstrate electrical circuits for motor forward, reverse, jogging, inching operation.
C303.3	Design, Develop and demonstrate pneumatic circuits using 2,3,5 way pneumatic valves, motor and cylinders.
C303.4	Design, develop and demonstrate hydraulic circuit using 2 ,3 5 way hydraulic valves, motor /cylinders.
C303.5	Select and Explain auxiliary components (fuses, circuit breakers, feeders) for particular application.
C303.6	Classify the hazardous area and materials as per NEC standards

Subject Code	Control System Design (306264)
C304.1	Explain and analyze control system with and without the compensator.
C304.2	Make use of Root Locus and Bode Plot for design of compensator for given specifications.
C304.3	Determine PID controller parameters using Ziegler-Nichols and Cohen-Coon Methods.
C304.4	Apply direct synthesis approach for design of feedback controller.
C304.5	Analyze the system in state space using the concept of controllability, observability and state transition matrix.
C304.6	Design the state feedback controller, Full order state observer using Ackermann's, coefficient comparison method for given system.

Subject Code	Industrial Organisation and Management (306265)
C305.1	Apply the different management concepts and tools for given business situation.
C305.2	Explain the importance of quality and environmental standards.
C305.3	Explain the importance of Production Planning, Inventory Control and Supply Chain Management.
C305.4	Summarize the role of Human Resource Manager in industries.
C305.5	Utilize the knowledge of financial management at professional workplace.
C305.6	Explain ethical practices and Information Technology based modern tools.

Subject Code	Numerical Methods (306266)
C306.1	Apply range of mathematical and technical concepts to applications.
C306.2	Methods to learn control engineering.
C306.3	Able to find numerical solution.
C306.4	Able to solve numerical methods using software (C/Matlab).
C306.5	Able to develop the algorithm to implement mathematical solutions of any Problem

Course Outcomes
ACADEMIC YEAR:-2019-19
TE Semester-II

Subject Code	**Digital Signal Processing (306268)**
C308.1	Explain and Demonstrate the characteristics of signals and systems.
C308.2	Analyse the discrete time systems using Linear Convolution, Correlation and Z-transform methods.
C308.3	Analyse the discrete time systems using Discrete Time Fourier Transform.
C308.4	Apply the radix-2 FFT algorithms to determine the DFT of the given sequence.
C308.5	Design Infinite Impulse Response (IIR) filters to meet given specifications.
C308.6	Design Finite Impulse Response (FIR) filters to meet given specifications.

Subject Code	**Process Loop Components (306269)**
C309.1	Students will be able to recognize process variables and state types of transmitters.
C309.2	Students will be able to compute process characteristics and control system parameters
C309.3	Students will be able to apply tuning algorithm to control system.
C309.4	Students will be able to analyze Programmable Logic Controllers and create ladder diagrams.
C309.5	Students will be able to compare control valve characteristics and selection of valves.
C309.6	Students will be able formulate a problem to find control valve sizing for given process conditions.

Subject Code	**Unit Operations & Power Plant Instrumentation (306270)**
C310.1	Explain and classify unit operations used in process industries.
C310.2	Develop energy balance and mass balance equations for heat exchangers, evaporator, distillation.
C310.3	Explain and Classify the renewable and non-renewable methods of power generation.
C310.4	Discuss boiler instrumentation and safety interlocks in thermal power generation.
C310.5	Discuss turbine control, condition monitoring & power distribution instrumentation in thermal power plant.
C310.6	Compare and summarize the different power plants with safety and pollution issues.

Subject Code	Instrument and System Design (306271)
C311.1	Explain the concepts of system design and packaging standards (NEMA and IP) for the given requirement.
C311.2	Interpret the effect of interferences in system design and ways of minimization.
C311.3	Design, Develop and Demonstrate given application using single chip analog device(AD620, HCNR200/201,XTR110,AD594/595)
C311.4	Design, Develop and Demonstrate given application using single chip digital device (IC7107, ICM7217, CD4046, MCT2E).
C311.5	Make use of PCB designing rules for given specific application.
C311.6	Explain/Discuss the concepts of quality, reliability and importance of documentation in system design.

Subject Code	Bio- Medical Instrumentation (306272)
C312.1	Explain ECG, EMG, EEG measurements and able to select bio sensors.
C312.2	Measure and Analyze the ECG waveforms of the patient.
C312.3	Demonstrate the blood pressure, heart sounds measurement of the patient.
C312.4	Measure and Analyze the EEG waveforms of the patient.
C312.5	Explain the measurement parameters of ear and eye diagnosis.
C312.6	Explain and measure respiratory parameters using Spirometers.

Subject Code	Mini Project (306273)
C313.1	Planning and implementation of hardware/ software project.
C313.2	Prepare the budget for hardware requirement.
C313.3	Demonstrate the project.
C313.4	Work as a team member.

Course Outcomes
ACADEMIC YEAR:-2019-19
BE Semester-I

Subject Code	**Process Dynamics & Control (406261)**
C401.1	Determine dynamic elements and open loop characteristics of processes for design of feedback controller.
C401.2	Analyze process control loops to identify its significant elements.
C401.3	Evaluate closed loop control performance for PID algorithms (P, PI and PID).
C401.4	Illustrate Cascade, feed-forward, feed-back-feed-forward, Ratio, Selective, Split range and Inferential Control strategies for enhanced process control beyond conventional single-loop PID controllers .
C401.5	Design of control system for two input two output process by selecting an appropriate multiloop control configuration from characterizing loop interactions.
C401.6	Design of PID controller by direct synthesis and internal model control methods of model based techniques.

Subject Code	**Project Engineering &Management (406262)**
C402.1	Define objectives of project management and apply it for small project.
C402.2	Apply project management skills for better planning, scheduling, execution and monitoring.
C402.3	Learn to execute procurement activities.
C402.4	Develop and analyze Project engineering documents and drawing.
C402.5	Explain project detail engineering (like GA, BOM and MBOM, Cable engineering and cable selection) for applications.
C402.6	Identify the construction and commissioning activities during the project.

Subject Code	**Computer Techniques & Application (406263)**
C403.1	Explain the operating system functions in detail. Differentiate real time operating system and operating system.
C403.2	Evaluate the performance of any developed software.
C403.3	To use the proper communication channel and software for transforming and storing the data. Categorize IEEE standards for networking IEEE 802.3, IEEE 802.4, IEEE 802.5
C403.4	Distinguish between different Preventive, Corrective, Adaptive, Enhancement Illustrate system re-engineering concepts
C403.5	Criticize on / Interpret white box, black box testing, control structure testing, specific environment testing, comparison testing, orthogonal testing, strategic approach to testing, unit testing, integrated testing, validation testing, system testing
C403.6	Examine functionality of Software Development Life Cycle

Subject Code	Electrical Drives (Elective- I) (406264)
C404-A.1	**Distinguish** the basic and advance speed control techniques for motor.
C404-A.2	**Analyze** and **select** drive based on load torque and speed characteristics
C404-A.3	**Explain** working of various converters used in drive system
C404-A.4	**Select** a DC drive for given application.
C404-A.5	**Demonstrate** and **Select** AC drive for given application.
C404-A.6	**Understand** the concept of servo and traction drive.

Subject Code	Automotive Instrumentation (Elective- II) (406265)
C405-B.1	Explain fundamental of automobiles and electronic instrumentation systems used in it.
C405-B.2	Demonstrate automobile engine control systems.
C405-B.3	Summarize various types of sensors and actuators used in automobile control system.
C405-B.4	Illustrate the advanced automotive electronic control strategies.
C405-B.5	Explain auto body electronic control, Ergonomics & Safety in automotive vehicles.
C405-B.6	Distinguish hybrid and electrical vehicles.

Subject Code	Project Stage- I (406266)
C406.1	Identify and analyze the problem.
C406.2	Formulate the problem statement by applying the technical knowledge and skills.
C406.3	Design hardware and software to solve the identified problems.
C406.4	Utilize the team work to solve problems and make proper decisions.
C406.5	Develop an optimized solution for problem within available resources and time.
C406.6	Enhance the technical as well as non-technical skills (writing, communication)

Course Outcomes
ACADEMIC YEAR:-2019-19
BE Semester-II

Subject Code	**Process Instrumentation (406268)**
C408.1	Apply & Analyze different instrumentation approaches (feedback, feedforward & cascade) to heat exchanger and Design PID controllers for heat exchangers
C408.2	Understands safety interlocks, burner management system (BMS) & optimization of efficiency in boiler, Classify manipulated & controlled variables, Apply & Analyze controls by approaches (Ratio, selective & split-range) and Design controllers for industrial boilers
C408.3	Apply and Analyze instrumentation & controls to distillation column. (flow control, top & bottom composition, reflux ratio & pressure control)
C408.4	Classify dryers & evaporators, Apply & Analyze instrumentation and control by using feedback, feedforward and cascade strategies.
C408.5	Understands basic factors governing conduct of reaction, stability, time constant and effect of lag, types of reactors (continuous & batch) and Apply & Analyze different controls (flow, temperature, pH, sequential & logic) to types of reactor.
C408.6	Ability classify pumps & compressors and Apply basic controls to pumps & compressors.

Subject Code	**Industrial Automation (406269)**
C409.1	Explain role of Industrial automation and their levels w.r.t. their performance criteria.
C409.2	Compare and Select communication protocols required in industrial automation
C409.3	Design, develop and Implement a PLC Programme.
C409.4	Develop and Implement SCADA application to Interface with PLC.
C409.5	Design, develop and Implement a DCS Programme.
C409.6	Enlist and Explain Process safety management systems and IEC standards

Subject Code	**Robotics and Automation (Elective- III) (406270)**
C410.1	The students will be able to identify and describe the classification of robot manipulators and will be able to list manufacturers of robot
C410.2	The students will be able to elaborate various characteristics of manipulator arms and will be able to describe various applications of machine vision in robots and will be able to select controller for machine vision.
C410.3	students will be able to understand robot kinematics, dynamics, simulate robot inverse-kinematics, compare robot programming methods
C410.4	Students will be able to analyze robot programming methods
C410.5	Students will be able to analyze mobile robots control and able to understand path planning
C410.6	Students will be able to recognize importance of case studies and will be able to select suitable robot for particular application.

Subject Code	Renewable Energy Systems (Elective- IV) (406271)
C411.1	Identify the usage of renewable energy systems
C411.2	Understand the requirements of solar panels for typical applications
C411.3	To comprehend the requirements of energy storage systems.
C411.4	Assess the potential and economic viability of the utilization of a renewable-energy source in energy estimation & panel sizing.
C411.5	Recognize the current and future role, applications of renewable energy.
C411.6	To understand the requirements of wind energy systems.

Subject Code	Project Stage –II (406272)
C412.1	Identify and analyze the problem.
C412.2	Formulate the problem statement by applying the technical knowledge and skills.
C412.3	Design hardware and software to solve the identified problems.
C412.4	Utilize the team work to solve problems and make proper decisions.
C412.5	Develop an optimized solution for problem within available resources and time.
C412.6	Enhance the technical as well as non-technical skills (writing, communication)

Subject Code	Online Certification Course (406273)
C413.1	Analyze various online courses offered by MHRD, Government of India and / or other Research Institutes.
C413.2	Select courses based on their interests and course's relevance to their engineering program.
C413.3	Enroll and access courses on MOOCs.
C413.4	Meet the assessment criteria set by the Research Institute or as decided by the Institutional Coordinator for this course.

End of Report