



MARATHA VIDYA PRASARAK SAMAJ'S
KARMAVEER ADV. BABURAO GANPATRAO THAKARE
COLLEGE OF ENGINEERING



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

Department of Instrumentation & Control Engineering

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

- 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

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 along with its characteristics.
C202.2	Demonstrate displacement sensors and transducers.
C202.3	Choose suitable sensor for Velocity, Speed, Vibration and Acceleration measurement.
C202.4	Demonstrate force sensors and transducers.
C202.5	Use pressure sensors and transducers for specific applications.
C202.6	Design the temperature sensors such as RTD, thermocouple and LM35 for temperature measurement.

Subject Code	Basic Instrumentation (206262)
C203.1	Apply the fundamentals of instrumentation in measurements and calibration of instruments.
C203.2	Demonstrate extension of ammeter and voltmeter measurement range.
C203.3	Select bridge circuits to measure unknown resistance and capacitance.
C203.4	Illustrate electrical parameters measurement with the help of oscilloscopes.
C203.5	Discuss digital instruments for parameter measurement.
C203.6	Make use of recorder and function generator.

Subject Code	Linear Integrated Circuits (206263)
C204.1	Illustrate significance of operational amplifier characteristics.
C204.2	Analyze closed loop configurations of operational amplifier.
C204.3	Analyze the performance of linear applications using operational amplifier.
C204.4	Analyze the performance of non-linear applications using operational amplifier.
C204.5	Design timer using IC 555 and linear voltage regulator circuits.
C204.6	Analyze active filter circuit performance.

Subject Code	Network Theory (206264)
C205.1	Analyze electrical network using mesh current and node voltage equations.
C205.2	Apply Network Theorems for the analysis of DC Networks
C205.3	Derive transfer functions for electrical networks for stability analysis.
C205.4	Derive Z, Y, H, ABCD parameters and their Interrelationship for two port Networks.
C205.5	Determine R, L and C components of RL, RC and LC driving point functions using Foster and Cauer forms.
C205.6	Describe the design of filters and attenuators.

Subject Code	Programming Languages (206265)
C206.1	Develop C programs for simple arithmetic operations.
C206.2	Illustrate searching and sorting algorithms using arrays & functions in C.
C206.3	Test C program for stack and queue operations using arrays.
C206.4	Develop C program for matrices operations and code conversions.
C206.5	Apply array of structure concepts for solving polynomial addition and data base management problems.
C206.6	Use graphics commands for tank filling, football play simulation.

Subject Code	Audit Course (Road Safety)
C207.1	Understand the health, legal and safety related issues of society.
C207.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C207.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.

Course Outcomes

ACADEMIC YEAR:-2019-20

SE Semester-II

Subject Code	Sensors & Transducers-II (206267)
C208.1	Analyze characteristics of flow measuring sensors from their operating principles.
C208.2	Select sensor for the measurement of tank liquid level.
C208.3	Select sensor for the measurement of viscosity and density.
C208.4	Illustrate pH sensor, Proximity sensors and Conductivity sensor.
C208.5	Describe the importance of signal conditioning devices for sensors.
C208.6	Design signal conditioning circuit for required specifications using RTD, Thermocouple.

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	Analyze 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 build, implement software programming using Labview to solve engineering problems

Subject Code	Digital Techniques (206270)
C211.1	Explain the concepts of Boolean algebra, number systems, codes and their conversion.
C211.2	Classify logic families and Simplify the digital circuits by using Boolean algebra, K-map, Quine-McClusky technique.
C211.3	Analyze, Design and Build the combinational logic circuits using Logic Gates.
C211.4	Demonstrate SR, D, T and JK flip-flop.
C211.5	Analyze, Design and Build the sequential Logic circuits using flip-flops, registers and counters.
C211.6	Summarize memory devices and design simple applications of digital system.

Subject Code	Industrial Drives (206271)
C212.1	Discuss SCR, UJT and MOSFET based on their characteristics.
C212.2	Analyze input/output waveforms of converters, choppers and inverters.
C212.3	Examine DC motors based speed & torque parameters.
C212.4	Examine single phase AC motors based speed & torque parameters.
C212.5	Discuss control techniques for DC motors using control rectifiers and choppers.
C212.6	Discuss control techniques for single phase AC motors using variable frequency drives.

Subject Code	Soft Skills (206271)
C213.1	Use of SWOT analysis to realize oneself and set personal and career goals (short term, long term).
C213.2	Develop verbal and non-verbal communication skills using IT tools.
C213.3	Develop Listening skill, participate in group discussions, interpret the subject, comment and summarize .
C213.4	Build their resume effectively referring latest online websites.
C213.5	Minimize work stress effectively using different techniques
C213.6	Develop leadership qualities and function effectively in a team.

Subject Code	Drives Control Laboratory (206273)
C214.1	Illustrate mathematical functions using MATLAB
C214.2	Analyze the transient response parameters of 1 st and 2 nd order electrical circuits.
C214.3	Analyze the stability of system using root locus and bode plot methods.
C214.4	Analyze the SCR characteristics.
C214.5	Use UJT for SCR triggering.
C214.6	Design speed and direction control system for dc motor using control rectifier circuit.

Subject Code	Audit Course (Road Safety)
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.

Course Outcomes

ACADEMIC YEAR:-2019-20

TE Semester-I

Subject Code	Embedded System Design (306261)
C301.1	Discuss architecture of 8051 microcontroller and its basic programming.
C301.2	Develop the Embedded System programs using Timer/Counter and Interrupts of 8051 microcontroller.
C301.3	Develop application of 8051 Microcontroller with LED/LCD displays, Keyboards, DAC/ADC peripheral devices.
C301.4	Design real time applications using 8051 microcontrollers with Sensors, Stepper motor & Relays.
C301.5	Distinguish between AVR and 8051 microcontrollers.
C301.6	Discuss Timer/counter, UART & ADC of AVR microcontroller.

Subject Code	Instrumental Methods for Chemical Analysis (306262)
C302.1	Discuss instrumental and chemical methods for samples analysis.
C302.2	Analyze sample concentration using spectrophotometer.
C302.3	Analyze the sample concentration using flame photometer.
C302.4	Describe fluorimeter, phosphorimeter, nuclear magnetic resonance spectrometry and gas analyzers for sample analysis.
C302.5	Analyze given samples using Gas Chromatograph & HPLC.
C302.6	Explain the use of X-ray Spectrometry and radiation detectors for sample analysis.

Subject Code	Control System Components (306263)
C303.1	Demonstrate the working of switches, relays and contactors for controlling single/three phase motors.
C303.2	Develop electrical circuits for motor forward, reverse, jogging, inching operation.
C303.3	Develop pneumatic circuits using 2, 3, 5 way pneumatic valves, motor and cylinders.
C303.4	Develop hydraulic circuit using 2, 3, 5 way hydraulic valves, motor /cylinders.
C303.5	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	Design compensator for the given specifications using Root Locus.
C304.2	Design compensator for the given specifications using Bode Plot
C304.3	Determine PID controller parameters using Ziegler-Nichols and Cohen-Coon Methods.
C304.4	Design PID controller using direct synthesis approach.
C304.5	Analyze the system using controllability, observability and state transition matrix.
C304.6	Design the state feedback controller, full order state observer using Ackermann's, formula and coefficient comparison method.

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

Subject Code	Numerical Methods (306266)
C306.1	To make use of code (C/MATLAB) to find out the roots of a non-linear equation using Bisection method & Newton's method.
C306.2	To make use of methods used in control engineering.
C306.3	Make use of Gauss-Elimination method to determine the solutions of a system consisting of linear equations.
C306.4	Select and apply Trapezoidal or Simpson's rule to find the integral of the given equation.
C306.5	To find numerical solution of ordinary differential equations by Euler's and Runge-Kutta method.
C306.6	To find the largest Eigen value of a matrix by power-method

Subject Code	Seminar
C307.1	Identify , understand and discuss current, real-world instrumentation and control issues from research literature.
C307.2	Distinguish and integrate multidisciplinary differing forms of knowledge in terms of data interpretation.
C307.3	To contemplate/create innovative idea and present it.
C307.4	Improve oral and written communication skills by creating report in Latex/equivalent editor.
C307.5	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.
C307.6	Apply ethical principles and respect in interaction with others.

Subject Code	Audit Course (Solar Thermal Systems)
C308.1	Understand the importance of renewable energy source.
C308.2	Discuss the need for renewable energy development and present report effectively using optimal resources at individual and group level using modern tools.
C308.3	Practice lifelong learning about the role and responsibility of engineers towards society in renewable energy domain.

Course Outcomes
ACADEMIC YEAR:-2019-20
TE Semester-II

Subject Code	Digital Signal Processing (306268)
C309.1	Explain the characteristics of signals and systems.
C309.2	Analyse the discrete time systems using Linear Convolution, Correlation and Z-transform methods.
C309.3	Analyse the discrete time systems using Discrete Time Fourier Transform.
C309.4	Determine the DFT of the given sequence using radix-2 DIT and DIF algorithm.
C309.5	Design Infinite Impulse Response (IIR) filters for given specifications.
C309.6	Design Finite Impulse Response (FIR) filters for given specifications.

Subject Code	Process Loop Components (306269)
C310.1	Explain process control variables and transmitters.
C310.2	Apply knowledge of Process Characteristics and Control Actions.
C310.3	Determine tuning parameters of PID controller.
C310.4	Develop and implement basic ladder Logic diagrams using Programmable Logic Controllers (PLC).
C310.5	Explain Control Valve characteristics, terminology and types.
C310.6	Determine control valve size for given process conditions.

Subject Code	Unit Operations & Power Plant Instrumentation (306270)
C311.1	Discuss unit operations used in process industries.
C311.2	Derive energy balance and mass balance equations for heat exchanger, evaporator and distillation column.
C311.3	Describe the renewable and non-renewable methods of power generation.
C311.4	Analyze boiler control loops and safety interlocks in thermal power plant.
C311.5	Analyze turbine control loops using condition monitoring systems.
C311.6	Analyze thermal, hydroelectric, wind, solar, nuclear power plant on the basis of safety and pollution issues.

Subject Code	Instrument and System Design (306271)
C312.1	Analyze the concepts of system design and packaging standards (NEMA and IP) for the given requirement.
C312.2	Interpret the effect of interferences in system design and ways of minimization.
C312.3	Design given application using single chip analog device (AD620, HCNR200/201, XTR110, AD594/595)
C312.4	Design given application using single chip digital device (IC7107, ICM7217, CD4046, MCT2E).
C312.5	Design of PCB for given specific application.
C312.6	Discuss the concepts of quality, reliability and importance of documentation in system design.

Subject Code	Bio-Medical Instrumentation (306272)
C313.1	Discuss bio sensors for ECG, EMG and EEG measurements.
C313.2	Select amplifier, filter, averaging and integrator circuit for the ECG analysis
C313.3	Analyze measurements of blood pressure, heart sounds and blood flow for cardiovascular system.
C313.4	Analyze the EEG measurement technique using 10-20 electrode system.
C313.5	Discuss audiometer and ophthalmoscope for ear and eye diagnosis.
C313.6	Analyze respiratory system parameters using spirometers and gas analyzers.

Subject Code	Mini Project (306273)
C314.1	Identify, select and undertake mini-project work related to engineering.
C314.2	Explain the product development cycle.
C314.3	Plan and organize the mini project work.
C314.4	Execute the mini-project work with all constraints (time and cost).
C314.5	Develop hardware by learning PCB design, Soldering, testing and troubleshooting techniques.
C314.6	Demonstrate and document the mini project work.

Subject Code	Audit Course (Entrepreneurship Development)
C315.1	Understand the importance of entrepreneurship.
C315.2	Discuss the need for entrepreneurship development and present report effectively using optimal resources at individual and group level using modern tools.
C315.3	Practice lifelong learning about the role and responsibility of the entrepreneurs and practice in life.

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

Subject Code	Process Dynamics & Control (406261)
C401.1	Design of feedback controller using mathematical process model.
C401.2	Analyze Flow, Pressure, Liquid level, and Temperature control loops from their characteristics.
C401.3	Evaluate closed loop control performance of process using PID algorithms.
C401.4	Illustrate multi-loop control strategies for process control applications.
C401.5	Design of control system for multivariable process.
C401.6	Design of model-based controller for time delay systems.

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	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	Differentiate real time operating system and Windows operating system based on functionalities.
C403.2	Evaluate the performance of software using pdf reader.
C403.3	Use proper communication channel and software for transforming and storing the data.
C403.4	Illustrate system re-engineering concepts and preventive, corrective, adaptive and enhancement maintenance for software.
C403.5	Relate white box, black box testing, control structure testing, comparison testing, orthogonal testing, unit testing, integrated testing, validation testing, system testing.
C403.6	Discuss 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 drive based on torque and speed characteristics.
C404-A.3	Explain converters (Choppers, Rectifiers, Inverters) used in drive system.
C404-A.4	Select a DC drive for given application.
C404-A.5	Demonstrate AC drive for given application.
C404-A.6	Explain the concepts of servo and traction drive.

Subject Code	Automotive Instrumentation (Elective-II) (406265)
C405A.1	Demonstrate fundamentals and electronic systems for automobile instrumentation
C405A.2	Articulate automobile engine control systems for condition monitoring of engine parameters and emission control
C405A.3	Summarize type of sensors and actuators used in automobile control system.
C405A.4	Illustrate the advanced automotive control systems for the human safety.
C405A.5	Summarize auto body electronic control, Ergonomics & Safety for human comfort.
C405A.6	Articulate the Automatic Driver Assist System for hybrid and electrical vehicles.

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.

Course Outcomes

ACADEMIC YEAR:-2019-20

BE Semester-II

Subject Code	Process Instrumentation (406268)
C408.1	Analyze temperature control strategies for heat exchangers.
C408.2	Select control schemes for process variables in boiler.
C408.3	Illustrate control schemes used for top and bottom composition control in distillation column.
C408.4	Illustrate control loops used in Dryer and Evaporator.
C408.5	Analyze control techniques used for chemical reactor.
C408.6	Select control loops for pumps and compressors.

Subject Code	Industrial Automation (406269)
C409.1	Describe role of Industrial automation and hierarchy of different automation tools with respect to their performance criteria.
C409.2	Compare communication protocols required in industrial automation
C409.3	Develop a PLC Programme for industrial application.
C409.4	Develop SCADA application to Interface with PLC.
C409.5	Develop a DCS Programme for industrial application.
C409.6	Explain Process safety management systems and IEC standards

Subject Code	Robotics and Automation (Elective-III) (406270)
C410.1	Identify and describe the classification of robot manipulators and will be able to list manufacturers of robot.
C410.2	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	Understand robot kinematics, dynamics, simulate robot inverse-kinematics, compare robot programming methods.
C410.4	Demonstrate robot programming methods.
C410.5	Discuss mobile robots control and able to understand path planning.
C410.6	Recognize importance of case studies and will be able to select suitable robot for particular application.

Subject Code	Renewable Energy Systems (Elective-IV) (406271)
C411A.1	Compare different renewable energy sources.
C411A.2	Analyze of solar panel system based on characteristics and efficiency.
C411A.3	Compare various energy storage systems based on their characteristics and specifications.
C411A.4	Design of solar panel system based on various loads.
C411A.5	Use of solar panel system for domestic and industrial applications.
C411A.6	Discuss requirements of wind energy conversion systems based on site selection and wind resource assessment.

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	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.
C413.5	Submit assignments/document of the OCC work.
C413.6	Completion various online courses offered by MHRD, Government of India and / or other Research Institutes.



Instrumentation & Control Engineering Department

Course Outcomes

AY 2020-21

Course Outcomes

ACADEMIC YEAR: -2020-21

SE Semester-I

Course Code	Engineering Mathematics-III
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
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
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
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
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
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
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 III
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.

Course Outcomes

ACADEMIC YEAR: -2020-21

SE Semester-II

Course Code	Control Systems
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
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
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
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
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
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 IV
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.

Course Outcomes

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TE Semester-I

Course Code	Embedded System Design
C301.1	Discuss architecture of 8051 microcontroller and its basic programming.
C301.2	Develop the Embedded System programs using Timer/Counter and Interrupts of 8051 microcontroller.
C301.3	Develop application of 8051 Microcontroller with LED/LCD displays, Keyboards, DAC/ADC peripheral devices.
C301.4	Design real time applications using 8051 microcontrollers with Sensors, Stepper motor & Relays.
C301.5	Distinguish between AVR and 8051 microcontrollers.
C301.6	Discuss Timer/counter, UART & ADC of AVR microcontroller.

Course Code	Instrumental Methods for Chemical Analysis
C302.1	Discuss instrumental and chemical methods for samples analysis.
C302.2	Analyze sample concentration using spectrophotometer.
C302.3	Analyze the sample concentration using flame photometer.
C302.4	Describe fluorimeter, phosphorimeter, nuclear magnetic resonance spectrometry and gas analyzers for sample analysis.
C302.5	Analyze given samples using Gas Chromatograph & HPLC.
C302.6	Explain the use of X-ray Spectrometry and radiation detectors for sample analysis.

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

Course Code	Control System Design
C304.1	Design compensator for the given specifications using Root Locus.
C304.2	Design compensator for the given specifications using Bode Plot.
C304.3	Determine PID controller parameters using Ziegler-Nichols and Cohen-Coon Methods.
C304.4	Design PID controller using direct synthesis approach.
C304.5	Analyze control system using controllability, observability and state transition matrix.
C304.6	Design state feedback controller, full order state observer using Ackermann's formula and coefficient comparison method.

Course Code	Industrial Organisation and Management
C305.1	Apply the management concepts and tools for business situation.
C305.2	Describe the importance of quality and environmental standards.
C305.3	Discuss the importance of Production Planning, Inventory Control and Supply Chain Management.
C305.4	Summarize the role of Human Resource Manager in industries.
C305.5	Use the knowledge of financial management.
C305.6	Describe ethical practices and Information Technology based modern tools.

Course Code	Numerical Methods (306266)
C306.1	To make use of code (C/MATLAB) to find out the roots of a non-linear equation using Bisection method & Newton's method.
C306.2	To make use of methods used in control engineering.
C306.3	Make use of Gauss-Elimination method to determine the solutions of a system consisting of linear equations.
C306.4	Select and apply Trapezoidal or Simpson's rule to find the integral of the given equation.
C306.5	To find numerical solution of ordinary differential equations by Euler's and Runge-Kutta method.
C306.6	To find the largest Eigen value of a matrix by power-method

Course Code	Seminar
C307.1	Identify , understand and discuss current, real-world instrumentation and control issues from research literature.
C307.2	Distinguish and integrate multidisciplinary differing forms of knowledge in terms of data interpretation.
C307.3	To contemplate /create innovative idea and present it.
C307.4	Improve oral and written communication skills by creating report in Latex/equivalent editor.
C307.5	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.
C307.6	Apply ethical principles and respect in interaction with others.

Course Code	Audit Course (TE)
C308.1	Understand the fundamentals of 3D Printing required in industry.
C308.2	Discuss the ability to design, manufacture, and test a customized part in as little time as possible
C308.3	Understand advantage of 3D printing is that any given printer can create almost anything that fits within its build volume

Course Outcomes

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TE Semester-II

Course Code	Digital Signal Processing
C309.1	Explain the characteristics of signals and systems.
C309.2	Analyse the discrete time systems using Linear Convolution, Correlation and Z-transform methods.
C309.3	Analyse the discrete time systems using Discrete Time Fourier Transform.
C309.4	Determine the DFT of the given sequence using radix-2 DIT and DIF algorithm
C309.5	Design Infinite Impulse Response (IIR) filters for given specifications.
C309.6	Design Finite Impulse Response (FIR) filters for given specifications.

Course Code	Process Loop Components
C310.1	Discuss process variables and transmitters for process control loops.
C310.2	Illustrate process characteristics and effect of control action on process.
C310.3	Determine PID controller parameters using tuning methods.
C310.4	Develop PLC ladder logic diagram for processes.
C310.5	Summarize control valve characteristics for control loops.
C310.6	Select control valve sizing for given process conditions using software.

Course Code	Unit Operations & Power Plant Instrumentation
C311.1	Discuss unit operations used in process industries.
C311.2	Derive energy balance and mass balance equations for heat exchanger, evaporator and distillation column.
C311.3	Describe the renewable and non-renewable methods of power generation.
C311.4	Analyze boiler control loops and safety interlocks in thermal power plant.
C311.5	Analyze turbine control loops using condition monitoring systems.
C311.6	Analyze thermal, hydroelectric, wind, solar, nuclear power plant on the basis of safety and pollution issues.

Course Code	Instrument and System Design (306271)
C312.1	Analyze the concepts of system design and packaging standards (NEMA and IP) for the given requirement.
C312.2	Interpret the effect of interferences in system design and ways of minimization.
C312.3	Design given application using single chip analog device (AD620, HCNR200/201, XTR110, AD594/595)
C312.4	Design given application using single chip digital device (IC7107, ICM7217, CD4046, MCT2E).
C312.5	Design of PCB for given specific application.
C312.6	Discuss the concepts of quality, reliability and importance of documentation in system design.

Course Code	Bio-Medical Instrumentation
C313.1	Discuss bio sensors for ECG , EMG and EEG measurements.
C313.2	Select amplifier, filter, averaging and integrator circuit for the ECG analysis
C313.3	Analyze measurements of blood pressure, heart sounds and blood flow for cardiovascular system.
C313.4	Analyze the EEG measurement technique using 10-20 electrode system.
C313.5	Discuss audiometer and ophthalmoscope for ear and eye diagnosis.
C313.6	Analyze respiratory system parameters using spirometers and gas analyzers.

Course Code	Mini Project
C314.1	Identify, select and undertake mini-project work related to engineering.
C314.2	Explain the product development cycle.
C314.3	Plan and organize the mini project work.
C314.4	Execute the mini-project work with all constraints (time and cost).
C314.5	Develop hardware by learning PCB design, Soldering, testing and troubleshooting techniques.
C314.6	Demonstrate and document the mini project work.

Course Code	Audit Course (TE)
C315.1	Understand the fundamentals of Artificial Intelligence and Robotics.
C315.2	Discuss the ability of AI facilitates decision-making by making the process faster and smarter
C315.3	Understand artificially intelligent robot with a high level of autonomy,

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BE Semester-I

Course Code	Process Dynamics and Control
C401.1	Design of feedback controller using mathematical process model.
C401.2	Analyze Flow, Pressure, Liquid level, and Temperature control loops from their characteristics.
C401.3	Evaluate closed loop control performance of process using PID algorithms.
C401.4	Illustrate multi-loop control strategies for process control applications.
C401.5	Design of control system for multivariable process.
C401.6	Design of model-based controller for time delay systems.

Course Code	Project Engineering & Management
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	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.

Course Code	Computer Techniques and Applications
C 403.1	Differentiate real time operating system and Windows operating system based on functionalities.
C 403.2	Evaluate the performance of software using pdf reader.
C 403.3	Use proper communication channel and software for transforming and storing the data.
C 403.4	Illustrate system re-engineering concepts and preventive, corrective, adaptive and enhancement maintenance for software.
C 403.5	Relate white box, black box testing, control structure testing, comparison testing, orthogonal testing, unit testing, integrated testing, validation testing, system testing.
C 403.6	Discuss functionality of Software Development Life Cycle.

Course Code	Electrical Drives
C404-A.1	Distinguish the basic and advance speed control techniques for motor.
C404-A.2	Analyze drive based on torque and speed characteristics.
C404-A.3	Explain converters (Choppers, Rectifiers, Inverters) used in drive system.
C404-A.4	Select a DC drive for given application.
C404-A.5	Demonstrate AC drive for given application.
C404-A.6	Explain the concepts of servo and traction drive.

Course Code	Automotive Instrumentation (Elective- II)
C405A.1	Demonstrate fundamentals and electronic systems for automobile instrumentation
C405A.2	Articulate automobile engine control systems for condition monitoring of engine parameters and emission control
C405A.3	Summarize type of sensors and actuators used in automobile control system.
C405A.4	Illustrate the advanced automotive control systems for the human safety.
C405A.5	Summarize auto body electronic control, Ergonomics & Safety for human comfort.
C405A.6	Articulate the Automatic Driver Assist System for hybrid and electrical vehicles.

Course Code	Project Stage-I
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.

Course Code	Audit Course
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.

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BE Semester-II

Course Code	Process Instrumentation
C408.1	Analyze temperature control strategies for heat exchangers.
C408.2	Select control schemes for process variables in boiler.
C408.3	Illustrate control schemes used for top and bottom composition control in distillation column.
C408.4	Illustrate control loops used in Dryer and Evaporator.
C408.5	Analyze control techniques used for chemical reactor.
C408.6	Select control loops for pumps and compressors.

Course Code	Industrial Automation
C409.1	Explain role of Industrial automation and their levels w.r.t. their performance criteria.
C409.2	Compare communication protocols required in industrial automation
C409.3	Develop a PLC Programme.
C409.4	Develop SCADA application to Interface with PLC.
C409.5	Develop a DCS Programme.
C409.6	Explain Process safety management systems and IEC standards

Course Code	Building Automation (Elective- III)
C410.1	Analyze instrumentation & control techniques to articulate the purpose and operation of HVAC system components and HVAC systems.
C410.2	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.
C410.3	Analyze the needs and requirements for ventilation and its impact on design and energy and its impact on human comfort, productivity, and health.
C410.4	Analyze the control techniques used in chilled water and hot water systems.
C410.5	Compare the way in which a large fire alarm system would be connected and zoned.
C410.6	Analyze the instrumentation & control techniques that make up an Access Control System.

Course Code	Renewable Energy Systems (Elective- IV)
C411A.1	Compare different renewable energy sources.
C411A.2	Analyze of solar panel system based on characteristics and efficiency.
C411A.3	Compare various energy storage systems based on their characteristics and specifications.
C411A.4	Design of solar panel system based on various loads.
C411A.5	Use of solar panel system for domestic and industrial applications.
C411A.6	Discuss requirements of wind energy conversion systems based on site selection and wind resource assessment.

Course Code	Project Stage-II
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.

Course Code	Online Certification Course
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.
C413.5	Submit assignments/document of the OCC work.
C413.6	Completion various online courses offered by MHRD, Government of India and / or other Research Institutes.

Course Code	Audit Course
C414.1	Understand the health, legal and safety related issues of society.
C414.2	Discuss the need for sustainable development and present report effectively using optimal resources at individual and group level using modern tools.
C414.3	Practice lifelong learning about the role and responsibility towards the environment and practice in life.