Nirma University
School of Technology, Institute of Technology
Electronics & Instrumentation Engineering

B. TECH. SEMESTER -III

2EI301 Control Theory [3 1 0 4]

Course Learning Outcome:
At the end of the course, students will be able to -

- apply the basic concept of mathematical modeling for the control system
- analyze time and frequency response of control system
- evaluate the stability of linear control system

2EI302 Microprocessors and Microcontrollers [3 0 2 4]

Course Learning Outcome:
At the end of the course, students will be able to -

- illustrate the architecture of microcontroller and microprocessor
- develop assembly and C language programs for various applications
- design microcontroller based embedded system

2EI303 Basic Electronics [3 0 2 4]

Course Learning Outcome:
At the end of the course, students will be able to -

- analyze analog circuits
- design and analyze the sequential logic circuits
- evaluate the performance of various electronic circuits

2EI304 Circuit Theory [3 0 2 4]

Course Learning Outcome:
At the end of the course, students will be able to -

- develop an understanding of the fundamental principles & theorems of electrical networks
- analyze the performance of two port networks
- synthesize electrical networks

B. TECH. SEMESTER -IV

2EI401 Signals and Systems [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to -

- illustrate the representations and classifications of the discrete time signals and systems
- analyze the linear time invariant systems in time domain
- apply fourier transformation for discrete time signals and linear time invariant systems

2EI402 Industrial Electronics [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to -

- explain various power electronic devices
- simulate, analyse and develop different application circuits based on thyristors
- illustrate the principle of operation and applications industrial heating and welding

2EI403 Electrical and Electronics Measurement [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to -

- elaborate the concepts of different electrical and electronics measurements
- elaborate testing and measuring instruments for various applications
- analyze and develop various ac and dc bridge circuits

2EI404 Control system Design [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to -

- Analyse the control system using state space modeling
- design state feedback based controller and observer
- design controller using conventional methods

2EI405 Linear Integrated Circuits [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to -

- utilize different signal conditioning ICs for various applications.
- analyze the signal conditioning IC based circuits
- design various signal conditioning circuits.

B. TECH. SEMESTER -V

2EI501 Process Control [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to –

- illustrate various components of the feedback loop and develop mathematical model of the given process
- select the proper controller and apply the tuning rules to achieve optimum performance
- select advanced control strategy to achieve the objective

2EI502 Transducers and Measurement [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to –

- explain the fundamentals of transducers, sensors and measurement system
- discuss the operation of measurement systems for various parameters like temperature, pressure, flow, level etc.
- analyze, select and apply appropriate measurement system for given application

2EI503 Machine Learning [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- comprehend supervised and unsupervised machine learning algorithm and study the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- evaluate mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised, unsupervised and reinforcement learning
- design and implement various machine learning algorithms to solve real-world applications problems

B. TECH. SEMESTER -VI

2EI601 Industrial Drives and Control [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to –

- illustrate the operation of various power converters and electric drives
- simulate, analyze and design different circuits for power converters and electric drives
- realize the role of power converters and electric drives in industrial applications

2EI602 Industrial Instrumentation [3 0 2 4]

Course Learning Outcome:

At the end of the course, students will be able to -

- illustrate the fundamental principles of instruments and actuators used in industry.
- analyze and design the instrumentation system documents and drawings.
- realize the role of safety standards.

2EI603 Instrumentation Laboratory [0 0 2 1]

Course Learning Outcome:

At the end of the course, students will be able to –

- apply the knowledge of different programming techniques for virtual instrumentation
- design algorithm for measurement and control
- simulate industrial processes in computer environment.

Department Elective with Laboratory

2EIDE51 Embedded Controller based design [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- illustrate the architecture of AVR microcontrollers
- program AVR controllers in C and assembly language
- design and develop embedded systems based on AVR microcontrollers

2EIDE52 Advanced Microprocessor and its Application [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- illustrate the architecture of ARM microprocessor
- program ARM microprocessor using various programming techniques
- design ARM processor based embedded applications

2EIDE53 Advanced Microcontrollers and its Application [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- Illustrate the architecture of PIC microcontroller
- program microcontroller using various techniques
- design and develop Raspberry Pi based embedded applications

2EIDE54 Mechatronics [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- illustrate principles and working of devices and elements for mechatronics and robotics
- select and utilize various sensors and actuators for mechatronic and robotic systems
- perform simulation, systems level analysis and design for mechatronics and robotics

2EIDE55 Advanced Process Control [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- select the best pair of controlled-manipulating variable of (MIMO) process and design decoupler for MIMO process control
- analyse and design IMC based controller and Model Predictive Control
- interpret working of various types of adaptive control system and statistical process control
- analyse various optimization techniques

2EIDE56 Biomedical Instrumentation [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to -

- illustrate and analyze different diagnostic and therapeutic methods.
- analyze different medical imaging systems for different pathological diagnoses.
- utilize biomedical instruments for diagnostic purpose.

2EIDE57 Digital Design for Instrumentation [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- describe architecture and working of different types of programmable logic devices
- develop Verilog code for different types of combinational and sequential circuits
- implement applications related to instrumentation on programmable logic devices

2EIDE58 Digital Signal Processing [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- understand and analyze LTI systems in z-domain and frequency domain
- apply FFT algorithms
- design IIR and FIR digital filters and implement structures

2EIDE59 Image Processing and its Applications [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to -

- illustrate the fundamentals of image processing techniques
- illustrate and apply the feature detection and tracking algorithms
- apply the vision based algorithms in industrial applications

2EIDE60 Factory Automation [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to -

- recognize the fundamental principles of programmable logic controller
- program PLC using standard programming techniques
- develop an application-oriented project using PLC.

Department Elective without Laboratory:

2EIDE01 Advance Sensors [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- explain principle, construction and applications of advanced sensors
- analyze and select appropriate sensors for different applications
- apply appropriate sensors and instrumentation for emerging applications

2EIDE02 Robot Dynamics and Control [3 0 0 3]

Course Learning Outcome:
At the end of the course, students will be able to –

- illustrate kinematics analysis of robot systems
- interpret motion sequence tasks in robotic control

- analyze and design of control algorithm for path optimization in robotics

2EIDE03 Data Communication & Industrial Networking [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- explain the concepts of communication model and standards
- compare various industrial networking standards
- demonstrate the applications of communication protocols in the field of process automation

B. TECH. SEMESTER -VII

2EI701 Process Automation [3 0 2 4]

Course Learning Outcome:
At the end of the course, students will be able to –

1. discuss the fundamentals of programmable logic controller
2. design program using standards programming languages
3. illustrate the SCADA, HMI, DCS and industrial networking
4. develop an application orientated project using PLC

2EI702 Nonlinear and Digital Control [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to –

1.interpret the basics of Nonlinear control system
2.illustrate the basics of sampled data control system
3.analyze the nonlinear and discrete time system
4.design controller and observer for discrete time system

2EI703 Minor Project [0 0 4 2]

Course Learning Outcome:
After successful completion of the course, student will be able to –

1. make use of acquired knowledge for the problem identification and definition,
2. analyse the technical aspects of the project with a comprehensive and systematic approach,
3. propose and select the appropriate solution,
4. appraise the importance of an individual / team for effective execution,
5. compile and conclude the project with effective communication amongst peers, mentors and society.

2EI704 Summer Internship [0 0 0 1]

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

1. perceive a better understanding of the engineering workplace,
2. adapt competencies necessary for professional career,
3. value interpersonal and human relationship skills,
4. build the foundation for industrial internship / major project.

Department Elective

2EIDE61 Deep Learning for Vision System [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to –

1. illustrate basic architecture of convolution neural networks
2. evaluate existing practical vision systems
3. optimize convolutional neural network model
4. design deep learning based real life vision applications

2EIDE62 Robotic Control System [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to –

1. illustrate properties of robotic hardware useful in autonomous robots
2. relate the implementation of robots in real world complex applications
3. formulate solution algorithm related to localization, obstacle avoidance and mapping
4. develop control algorithm for decision making in intelligent robotic system

2EIDE63 Programming with Python & MATLAB [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to –

1. illustrate basics of Python and MATLAB programming
2. identify appropriate libraries of Python to apply for various computational problems.
3. develop applications using Python.
4. apply various techniques to solve engineering-related computational problems using MATLAB.

2EIDE64 Introduction to R programming [2 0 2 3]

Course Learning Outcome:
At the end of the course, students will be able to –

1. explain various constructs of R language
2. formulate various statistical functions using R language
3. evaluate models using R language

4. analyze and plot the time series data

2EIDE65 Fuzzy Control theory [2 0 2 3]

Course Learning Outcome:

At the end of the course, students will be able to –

- interpret basics of fuzzy set theory
- develop fuzzy inference system
- design fuzzy based control system
- apply fuzzy logic controller for various applications

Department Elective without Laboratory

2EIDE04 Maintenance of Instruments & Systems [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to –

1. summarize the role and responsibilities of instrumentation maintenance engineer
2. apply the concepts of calibration and maintenance for various applications
3. discuss the corrective measures for troubleshooting of instruments and systems
4. recommend methods and actions to be followed for safety of instruments and systems

2EIDE05 Power plant Automation [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to –

1. assess various operational aspects of power plant and compare thermal, nuclear and hydro power plant
2. evaluate various control systems of thermal power plant
3. examine various subsystems and health monitoring system of thermal power plant
4. optimize thermal power plant operation.

2EIDE06 Soft Sensors [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to -

1. explain the methods for soft sensor design
2. select appropriate model structure of soft sensor
3. model fault detection and diagnosis in industrial process
4. design soft sensor for industrial applications.

2EIDE07 System Identification [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to –

1. explain system identification and estimation techniques
2. identify the model structure & order determination for an unknown process from empirical data
3. apply estimation techniques for parametric & nonparametric models
4. design and validate the model for practical process applications

2EIDE08 VLSI Design [3 0 0 3]

Course Learning Outcome:

At the end of the course, students will be able to –

1. analyze the different digital VLSI circuits
2. model the CMOS circuit with equivalent parameters
3. design combinational, sequential and dynamic logic circuits using CMOS for given specifications.
4. develop various types of memory circuits

B. TECH. SEMESTER -VIII

2EI801 Major Project [0 0 22 11]

Course Learning Outcomes (CLO):

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

1. make use of acquired knowledge for the problem identification and definition related to industry / research / societal need,
2. analyse the technical aspects of the project with a comprehensive and systematic approach,
3. select the appropriate modern tool(s) and technique(s) for problem solving,
4. propose and select the appropriate and cost effective solution,
5. appraise the importance of an individual / team for effective execution,
6. value the health, environment, safety and ethical practices during the project,
7. perceive the possibility of scalability and scope of intellectual property rights,
8. compile and conclude the project with effective communication amongst peers, mentors and society,
9. develop life-long learning skills for productive career.