

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech in Electronics and Instrumentation Engineering
Semester:	VI
Course Code:	3EI105CC24
Course Title:	Industrial Instrumentation
Course Type:	Core
Year of Introduction:	2024-25

L	T	Practical component				C
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Course Learning Outcomes (CLOs):

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

1. realize the role of safety standards (BL2)
2. explain the fundamental principles of instruments and actuators used in industry (BL2)
3. learn Selection, Calibration, Installation and Maintenance of Field Devices (BL3)
4. design the instrumentation system documents and drawings. (BL4)

	Contents	Teaching hours (Total 45)
Unit-I	Introduction Introduction of Industrial Instrumentation, overview of different field devices and their applications in measurement and control.	03
Unit-II	Filed devices for industry I to P and P to I Converter, Pneumatic transmitter, electronic transmitter, Smart transmitter, Thumb rules of wiring and tagging.	06
Unit-III	Control valve, actuators and positioners Control valve parameters, Role of control valves in industries, Basic Parts of Control Valve, Flow characteristics of control valve, Calibration procedure of different valves, Basic of valve actuators, Type of actuators, Calibration of Actuators.	06
Unit-IV	Instrumentation drawings Introduction of different documentations Need of documentations, Overview of ISA standards documentations, Process Flow Sheets, Mechanical Flow Sheets, Piping and Instrumentation Drawing (P&ID) Instrument Index Sheets, Instrument Specification Sheets, Loop Wiring Diagram, Panel Drawings, Software packages for documentations, Case study of P&ID.	10
Unit-V	Safety systems standards Introduction to process safety, safety interlocks, risk terminologies, Process Hazard Analysis (PHA), Hazard and operability study (HaZOp), Safety Integrity Level (SIL), IEC, IP and NEMA standard.	08
Unit-VI	Selection, calibration, installation and maintenance of field devices Selection criteria for flow, temperature, level and pressure instruments, Range selection, Instrument calibration, Traceability with standard laboratories, Installation guidelines for various field instruments, Importance of maintenance, different approaches of maintenance.	07

Unit-VII Industrial internet of things

05

History of IOT, Definition, Architecture. Industry revolutions, Industry Revolution 4.0 –technology, opportunities and challenges, Hardware required: Sensors, Actuators, Routers, Switches, platforms for IOT.

Self Study:

The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

This shall consist of at least 10 practicals based on the above syllabus.

Suggested Reading:

1. W. G. Andrew & H. B. William, Applied Instrumentation In The Process Industries, Gulf Professional Publishing
2. M.D. Desai, Control System Components, Prentice Hall of India Publication
3. Frederick Meier and Clifford Meier, Instrumentation and Control Systems Documentation, ISA Publication
4. J.E. Gibson and F.B. Tuteur, Control System Components, McGraw Hill, 2013
5. Instrumentation, Automation, IoT and Emerging Technologies for Engineers: Handbook, by Madhukar Varshney Sanjay Galhan

Suggested List of Experiments:

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| 1. Introduction to Piping and Instrumentation Drawings. Design Piping and Instrumentation Drawings chemical processes. | (02 Hrs) |
| 2. Design Electrical Loop Drawings for basic processes using process P&ID. | (02 Hrs) |
| 3. Design Instrument Index Sheet for Process control application. | (02 Hrs) |
| 4. Understand the concept of P to I Convertor. | (02 Hrs) |
| 5. Study flow profile for different valve characteristics. | (02 Hrs) |
| 6. Understand the Concept of I to P convertor. | (02 Hrs) |
| 7. Calibration of P to I converter. | (02 Hrs) |
| 8. Calibration of I to P converter. | (02 Hrs) |
| 9. Understand the functionality of different control Valves. | (02 Hrs) |
| 10. Design Small IoT based application using Embedded Controller. | (02 Hrs) |
| 11. Design Small IoT based application using PLC and HMI. | (02 Hrs) |
| 12. Calibration of Thermocouple. | (02 Hrs) |

L = Lecture, T = Tutorial, P = Practical, C = Credit