

# NIRMA UNIVERSITY

<b>Institute:</b>	<b>Institute of Technology, School of Technology</b>
<b>Name of Programme:</b>	<b>Minor in Industrial Automation (Inter-disciplinary) Offered by BTech in Electronics and Instrumentation Engineering.</b>
<b>Semester:</b>	<b>VII</b>
<b>Course Code:</b>	<b>4EI403IE25</b>
<b>Course Title:</b>	<b>Industrial Instrumentation</b>
<b>Course Type:</b>	<b>Elective Course -II under Minor (Interdisciplinary)</b>
<b>Year of Introduction:</b>	<b>2024-25</b>

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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 (BL2)
3. explain selection, calibration, installation and maintenance of field device (BL5)
4. design the instrumentation system documents and drawings. (BL6)

Unit	Contents	Teaching hours (Total 45)
<b>Unit- I</b>	<b>Introduction</b> Introduction of Industrial Instrumentation, overview of different field devices and their applications in measurement and control.	03
<b>Unit- II</b>	<b>Filed devices for industry</b> I to P and P to I Converter, Pneumatic transmitter, electronic transmitter, Smart transmitter, Thumb rules of wiring and tagging.	06
<b>Unit- III</b>	<b>Control Valve, Actuators and Positioners</b> 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
<b>Unit- IV</b>	<b>Instrumentations Drawings</b> 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
<b>Unit- V</b>	<b>Safety Systems Standards</b> 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

<b>Unit- VI</b>	<b>Selection, Calibration, Installation and Maintenance of Field Devices</b> 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
<b>Unit- VII</b>	<b>Industrial Internet of Things</b> History of IOT, Definition, Architecture. Industry revolutions, Industry Revolution 4.0 –technology, opportunities and challenges, Hardware required: Sensors, Actuators, Routers, Switches, platforms for IOT.	05

#### 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.

#### Tutorial:

Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

#### 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*, PHI 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 Tutorials:

Sr. No	Title
1.	Introduction to Piping and Instrumentation Drawings. Design Piping and Instrumentation Drawings chemical processes
2.	Design Electrical Loop Drawings for basic processes using process P&ID
3.	Design Instrument Index Sheet for Process control application
4.	Understand the concept of P to I Convertor
5.	Study flow profile for different valve characteristics
6.	Understand the Concept of I to P convertor
7.	Calibration procedure of P to I converter and I to P converter
8.	Understand the functionality of different control Valves
9.	Calibration procedure of Thermocouple
10.	Understating IOT architecture and related case studies