

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>ME I Year Electronics (Sp. Digital Instrumentation) Semester-B</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>DIR2C2: Process Instrumentation and Industrial Control</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>
<b>Duration of paper: 3 Hours</b>							

**Course Objective:** To enable students to understand the basic concept of process instrumentation applicable in various industries. It will also give in depth knowledge regarding different type of control strategies instrumentation and controller used in processing industries.

### **COURSE CONTENT**

#### **Unit I**

##### **Fundamentals of Process Control**

Elements of process control loop, concept of process variables, set point, controlled variable, manipulated variable, load variable. Need for standardization of signals, current, voltage and pneumatic signal standards, concept of live & dead zero, Difference between converter & transmitter, Pneumatic to current converter, Current to pneumatic converter .

#### **Unit II**

##### **Types of Control Actions:**

Discontinuous:ON/OFF, Continuous: Proportional, integral, derivative, proportional-Integral, Proportional-Derivative, Proportional-Derivative-Integral

##### **Tuning of Controller:**

Quarter Amplitude Decay Ratio, Loop disturbance, optimum control, Measure of quality, stability criteria, Tuning methods: Process Reaction Curve (open loop), Ziegler Nichols (closed loop), set point tuning Vs load disturbance tuning.

#### **Unit III**

##### **Programmable Logic Controller (PLC):**

Continuous versus Discrete Process Control, ladder diagram using standard symbols, Architecture of PLC, PLC ladder diagram and instructions, PLC Programming for process applications.

##### **Complex Control Systems:**

Introduction, cascade, feed forward, Ratio Control, Anti Reset, Selector & Multivariable control scanners.

#### **Unit IV**

##### **Control Valve:**

Classification of control valves based on: Valve body. Construction, type of actuation, application etc. Control valve terminology: Range ability, turndown, valve capacity, Air to open, Air to close, valve gain etc. Control valve characteristics: Inherent & installed Control valve accessories. Types of actuators. Positioners: Application/Need, Types, Effect on performance of control valves.

#### **Unit V**

##### **Safety and Hazards:**

Explosion Proof Housing, Encapsulation, Sealing, & Immersion, intrinsic safety, Concept of safety cycle.

##### **DCS and SCADA:**

DCS architecture, system elements of DCS. Definition of SCADA, Application area of SCADA, Major elements of SCADA, Advantages and disadvantages of SCADA, Comparison of SCADA, DCS, PLC and Smart Instrumentation.

#### **Text Books and References:**

- [1] Curtis Johnson, "Process Control and Instrumentation Technology", Prentice-Hall of India Seventh ed., 2005.
- [2] B. G. Liptak, "Process Control, Instrument Engineering Hand book", Chilton Book Company, Third ed., 1995
- [3] Patranabies , "Principles of Process control", Tata Mc Graw Hill Pub, 2006
- [4] P. Harriott , "Process control", McGraw-Hill: New York, 1964
- [5] Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition System ", ISA publication 3<sup>rd</sup> Edition)
- [6] Dobrivoje Popovic and Vijay Bhatkar, "Distributed Computer Control for Industrial ",Marcel Dekker Inc.,1990