

Devi Ahilya University, Indore, India Institute of Engineering & Technology				IV Year B.E. (Electronics and Instrumentation)			
Subject Code & Name	Instructions Hours per Week			Credits			
<b>EIR7C4</b> Process Instrumentation & control	<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 Theory Paper: 3 Hours</b>							

### Learning Objectives:

The course aims to provide students with the knowledge about behaviour of industrial processes, builds the concepts related to operation and control of dynamic processes, and learn various strategies of processes control. Learn theoretical and practical aspects for the design and operation of process control systems.

### Prerequisites (if any):

Control System, Sensor & Transducers

## Course of Contents

### UNIT-I: Introduction to process control

Objectives of Control, Process Characteristics: Process Equation, degrees of freedom, process and control lag, dead time, load disturbance and its effect on processes, analog control, digital control, Self regulating processes, final control elements, valves and actuators, their various characteristics, piping and instrumentation diagram,

### UNIT-II: Control modes

Basic Control action, two position, multi-position, floating Control modes, Continuous controller modes: Proportional, integral, derivative, composite controller modes-I, P-D, P-I-D, comparisons of these control actions, design of various kinds of analog controllers, Parameters Adjustment, Controller tuning methods,

### UNIT-III : Controllers- other modes

Modeling of simple systems-gas liquid and thermal systems, Concept of resistance and capacitance, Nozzle-flapper system, Pneumatic relays and amplifiers, Hydraulic systems, realization of various kinds of controllers for hydraulic and pneumatic applications.

### UNIT-IV: Discrete state process control

Discrete state Control, Discrete state variables, Event sequence description, ladder diagram, relay sequencer, Programmable logic controller- Architecture, operation and programming

**UNIT-V: Case studies**

Cascade control, ratio control, feed-forward control, selective Control, Split range Control

Boiler Control: Combustion Control, Oxygen/CO trimming, Feedwater Control, Furnace Control, Steam temp. Control, Distillation column control

**Recommended books:**

1. D.P. Eckman “Automatic Process control” Wiley Publication.
2. Patranabies “Principles of Process control” Tata Mc Graw Hill Pub, (2006)
3. P. Harriott “Process control” McGraw-Hill: New York, 1964
4. Curtis Johnson “Process control Instrumentation Technology” Prentice Hall, New Delhi (2005)
5. B.G. Liptak “Hand Book of Process control” Taylor & Francis Ltd
6. Shinskey, “Process Control systems: Application, Design & Tuning” 4<sup>th</sup> Edition, McGraw Hill, Singapore (1996)

**Learning Outcomes:**

Upon Completing the Course, Student will able to:

1. Understand the basic principles, terminologies, mathematical analysis and block diagrams related to the industrial processes.
2. Comprehend the use of various components, instrumentation and strategies for controlling and fine tuning the process.
3. Develop skills for the efficient design of process control loops for process engineering plants.

**List of Experiments**

1. Study, design and fine tuning of a pressure based control loop.
2. Study, design and fine tuning of the flow based control loop.
3. Study the ratio control system for the mixing of two fluid.
4. Study cascade control based strategy for the control of liquid flow in a closed channel.
5. Design and development of advanced PC based multi process control system.
6. Study and implementation of various control strategies using temperature control system
7. Study of a PID controller.