PROCESS CONTROL

Course Code	19EE4701C	**Year**	IV	**Semester**	I
Course Category	Program Elective-IV	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand technical terms and concepts associated with process control domain
CO2	Analyze the basic control actions used in process industries
CO3	Develop, tune and implement PID Controllers to achieve desired performance for various processes
CO4	Develop & implement control schemes for various processes control applications
CO5	Extend the performance of the complex systems with advanced control strategies

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2						2							
CO2			3			3								
CO3			3								3		3	
CO4			2				3		2					2
CO5					1			2				1		1

SYLLABUS

Unit No.	Contents	Mapped CO
I	**Introduction to Process control:** Terms and objectives, piping and Instrumentation diagram, instrument terms and symbols. Regulatory and servo control, classification of variables. Process characteristics: Process equation, degrees of freedom, modeling of simple system, Self-regulating processes, interacting and non- interacting processes, Process lag, load disturbance and their effect on processes	**CO1**
II	**Controller modes:** Basic control action, two position, multi-position, floating control modes. Continuous controller modes: proportional, integral, derivative. Composite controller modes: P-I, P-D, P-I-D, Integral wind-up and prevention. Auto/Manual transfer, Bump less transfer. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow.	**CO2**

III	**Final control elements:** Pneumatic and electrical actuators, Valve positioners. Pneumatic and electrical dampers, Control valves types, construction details, various plug characteristics. Energy efficient valves - Valve sizing - selection of control valves. Inherent and installed valve characteristics. Fail-safe operation, Cavitations and flashing in control valves, Instrument air supply specifications.	**CO3**
IV	**Controller tuning Methods:** Evaluation criteria - IAE, ISE, ITAE. Process reaction curve method, continuous oscillation method, damped oscillation method. Auto tuning. Closed loop response of I & II order systems, with and without valve, measuring element dynamics.	**CO4**
V	**Advanced control system:** Cascade control, ratio control, feed forward control. Over-ride, split range and selective control. Multivariable process control, interaction of control loops. Introduction to Dynamic Matrix Control. Case Study, boiler drum level control.	**CO5**

Learning Resources

Text Books:

1. K.Krishna swamy, Process control, Anshan Publishers .2nd edition,june 2011.
2. Surekha Bhanot , Process control principles and applications , oxford university press, 2008.
3. D.R. Coughanowr, Steven E LeBlanc, Process Systems Analysis and Control, McGraw Hill, Singapore, 3rd Edition, 2009.
4. G.Stephanopoulos, Chemical Process Control-An Introduction to Theory and Practice Prentice Hall of India, New Delhi, 3rd Edition, 2008.

Reference Books:

1. B.W. Bequette, Process Control Modeling, Design and Simulation, Prentice Hall of India, New Delhi, 2004.
2. C.A.Smith and A.B Corripio., Principles and Practice of Automatic Process Control, John Wiley and Sons, New York, 3rd Edition 2005.
3. Paul W.Murril, Fundamentals of Process Control Theory, ISA press, New York, 3rd Edition, 2000.
4. Bela G. Liptak, Instrument Engineers' Handbook, Volume II: Process Control and Optimization, CRC Press, 4th Edition, 2005.

Learning Resources:

https://nptel.ac.in/courses/103/105/103105064/