

Advanced Process Control

CHE- 447	Advanced Process Control	2CH	
		Theory (2)	
Pre- req.	Nil	Category	Elective
Course Contents as per PEC Guidelines 2023-2024			
Introduction to Process Control: Why process control, Control Objectives and Benefits, process dynamics, Modelling tools for process dynamics, Inversion by partial fractions Review of basic concepts: (a) Incentives for process control, (b) Control block diagrams, Designing and tuning PID controllers Linear open loop systems: Response of first order systems, Higher order systems Linear Closed Loop systems: The Control systems, Controllers and Final control elements, Closed loop transfer functions. Modelling and Analysis for Process Control: Continuous-time internal model control (IMC) and IMC-based PID controllers, Algorithms for digital control, Dynamic Behavior of Typical Process Systems Enhancements to Single-Loop PID Feedback Control: Cascade Control, Feedforward Control, Adapting Single-Loop Control Systems for Non-linear Processes, Inferential Control, Level and Inventory Control, Single-variable Model Predictive Control Process response: Advanced Control strategies, Analysis of cascade control, feed forward control, Feedback Loop, ratio control, dead-time compensation, control valves, theoretical analysis of complex processes. Model predictive control, Stochastic control, Singular value analysis Frequency Response: Introduction, Techniques for control system design by frequency response, Integration of process design and process control Computers in process control: Features and tasks of microprocessor-based controllers, Distributed control.			

Weekly plan

Week /Lecture	Topic
1	Introduction to Process Control: Why process control, Control Objectives and Benefits, process dynamics, Modelling tools for process dynamics, Inversion by partial fractions
2	Review of basic concepts: (a) Incentives for process control, (b)Control block diagrams,
3	Designing and tuning PID controllers
4	Linear open loop systems: Response of first order systems, Higher order systems
5-6	Linear Closed Loop systems: The Control systems, Controllers and Final control elements, Closed loop transfer functions.
7-8	Modelling and Analysis for Process Control: Continuous-time internal model control (IMC) and IMC-based PID controllers, Algorithms for digital control, Dynamic Behavior of Typical Process Systems
9	MID TERM EXAM
10-11	Enhancements to Single-Loop PID Feedback Control: Cascade Control, Feedforward Control, Adapting Single-Loop Control Systems for Non-linear Processes, Inferential Control, Level and Inventory Control, Single-variable Model Predictive Control
12-13	Process response: Advanced Control strategies, Analysis of cascade control, feed forward control, Feedback Loop, ratio control, dead-time compensation, control valves, theoretical analysis of complex processes. Model predictive control, Stochastic control, Singular value analysis
14-15	Frequency Response: Introduction, Techniques for control system design by frequency response, Integration of process design and process control
16	Computers in process control: Features and tasks of microprocessor-based controllers, Distributed control.
17	Revision
18	End Semester Exam
TEXT AND REFERENCE BOOKS: • Steven E. LeBlanc Donald R. Coughanowr," Process Systems Analysis and Control"3rdEdition; McGraw Hill,2009. • Johnson, C.D., Process Control Instrumentation Technology. 8th Edition; Prentice Hall,2006. • 3Luyben, W.L.; Luyben,M.L., Essentials of Process Control. McGraw Hill,1997. • Marlin,T.E.,Process Control: Designing Processes and Control Systems for DynamicPerformance.2nd Edition; McGraw Hill,2000. • Ogunnaike, B. A.; Ray, W.H., Process Dynamics, Modeling,and Control. Oxford University Press,1994. • Smith, C. A.; Corripio, A., Principles and Practice of Automatic Process Control. 3rdEdition; John Wiley & Sons,2006. • Stephanopoulos,G., Chemical Process Control: An Introduction to Theory and Practice.Prentice Hall,1984.	