PROCESS CONTROL - I
Code : EI 601
Contacts : 3L+1T
Credits : 4

Module I [10]
General Review of Process, Process Control and Automation. Servo and Regulatory Control, Basic process control loop block diagram.
Characteristic parameters of a process – Process Quantity, Process Potential, Process Resistance, Process Capacitance, Process Lag, Self Regulation

Process modelling, process equations – their limitations - general approach. Typical processes and derivation of their transfer functions

Characteristics and functions of different modes of control actions : Schemes and analysis of On-Off, Multistep, Floating, Time Proportional, PID control
Effect of disturbances and variation in set point in process control.
Offset - why it appears and how it is eliminated – analysis and mathematical treatment

Module II [8]
Process Reaction Curves, Controllability - using (i) deviation reduction factors (ii) gain bandwidth product, State Controllability

Tuning of Controllers : both Closed and Open loop methods (Ziegler – Nichols, Cohen – Coon, PRC method and 3-C method of parameter adjustment)

Electronic PID controller design
Pneumatic Controllers - brief analysis

Module III [6]
Different control strategies - schemes, brief analysis and uses
(i) Ratio control
(ii) Cascade control
(iii) Feedforward control
(iv) Multivariable control

Module IV [8]
Final Control Element: Actuators (Pneumatic Actuators, Electrical Actuators) and Control Valves (Globe, Ball, Butterfly, Gate, Pinch), Different Parts, Fail Position, Valve characteristics, Cv, Single & Double Seated Valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise
Control Valve Accessories – Air Filter Regulator, I/P Converter, Pneumatic Positioner, Electro-Pneumatic Positioner, Limit Switches, Motion Transmitters
Brief study of Safety Valves and Solenoid valves

Module V [8]
Introduction to Programmable Logic Controllers – Basic Architecture and Functions; Input-Output Modules and Interfacing; CPU and Memory; Relays, Timers, Counters and their uses; PLC Programming and Applications.
Introduction to DCS(6+2)

Books:
1) D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
2) D. P. Eckman, Automatic Process control, John Wiley, New York
3) P. Harriott, Process control, Mc Graw Hill, New York
4) G. Stephanopoulos, Chemical process Control, PHI
5) C. D. Johnson, Process Control Instrumentation Technology, PHI
6) S. Bhanot, Process Control – Principles and Applications, Oxford Univ Press
7) S. K. Singh, Process Control, PHI
8) S. Sundaram, Process Dynamics and Control, Cengage Learning
9) B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia