ADVANCED PROCESS CONTROL

Course Code: 15CH2114

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Prerequisites: The student should have knowledge of basics of control system and Laplace transforms.

Course outcomes: On successful completion of the course, the student should be able to

CO1: Design / tune a controller for SISO systems and assess the stability of a closed – loop system by Routh – stability criteria, Bode &Nyquist stability criteria.

CO2: Develop internal model control structure and design IMC for stable and unstable processes.

CO3: Select proper input – output pairings for Multiple single input – single output controller by the application of Relative Gain Array technique and Design Ideal Decouplers for MIMO systems.

CO4: Differentiate between different Model Predictive Control Algorithms.

CO5: Formulate the state space representation of the system and apply z- transforms to discrete systems.

UNIT-I (10-Lectures)

Review of single input single out put (SISO) systems, Routh stability criteria. Frequency Response Analysis: Bode and Nyquist plots, effect of process parameters on Bode and Nyquist plots, closed loop stability concepts, Bode and Nyquist Stability.

UNIT-II (10-Lectures)

Internal Model control: Introduction to model based control, practical openloop controller design, generalization of the open-loop control design procedure, model uncertainty and disturbances. The IMC structure, IMC design procedure, effect of model uncertainty and disturbances. IMC in context of PID controller.

UNIT-III (10-Lectures)

Control-loop Interaction: Introduction, Motivation, the general pairing problem, the relative gain array, properties and application of the RGA. Multivariable Right Half Plane (RHP) Zeros and their performance limitations, Design of ideal Decouplers.

UNIT-IV (10-Lectures)

Model Predictive Control: Model forms of model predictive control, constrained and unconstrained approach, analysis of dynamic matrix control.

UNIT-V (10-Lectures)

State space and transfer function representation and their interrelationships. Sampling and Z-transforms, Open loop and closed loop response.

TEXT BOOKS

1. Wayne Bequette B., *"Process control: Modeling, Design and simulation",* PHI, 2003.
2. Stephanopoulos, "*Chemical Process Control: An Introduction to theory&Practices",*PHI,2010

REFERENCES:

1. Ogunnaike, B,. Ray W H, *"Process Dynamics, Modeling and Control",* Oxford University Press, 1994.
2. Seborg D.E. and Edgar T.F., Mellichamp D.A *"Process Dynamics and control",* Wiley, 2006.