AMCH21 INSTRUMENTATION & PROCESS CONTROL

UNIT-1 INTRODUCTION

1.1 Motivation for process control
1.2 Concept of feedback control
1.3 Process dynamics in time
1.4 Laplace and frequency domains
1.5 Concepts of stability and optimal control

UNIT-2 CHEMICAL PROCESS INSTRUMENTATION

2.1 General performance of Instruments
2.2 Transducers and their classification
2.3 Electrical passive and electrical active
2.4 Elastic,
2.5 Resistance
2.6 Capacitive and inductive transducers for temperature, level, flow and pressure Measurements
2.7 Other special types of instruments such as ultrasonic flow meter
2.8 Pyrometer and review of flow meters

UNIT-3 CONTROL VALVES

3.1 Types of valves
3.2 Inherent and effective valve characteristics
3.3 Selection and sizing of valves

UNIT-4 PROCESS DYNAMICS

4.1 Models of first and second order system and their transfer functions
4.2 Linearization of non-linear systems
4.3 Response of step, ramp, sinusoidal, pulse and impulse inputs
4.4 Systems in series – interacting and non-interacting

UNIT-5 MODES OF CONTROL

5.1 On-off control proportional
5.2 Integral
5.3 Derivative modes and their combinations
5.4 Open-loop behavior of controllers

UNIT-6 TRANSIENT RESPONSE

6.1 Closed – loop transfer functions
6.2 Transfer functions for servo and regulatory problems
6.3 Transient behavior of closed – loop systems

UNIT-7 STABILITY OF CONTROL SYSTEMS

7.1 Bounded input bounded output stability

7.2 Routh's stability criteria

UNIT-8 ROOT LOCUS

8.1 Concept of root – locus
8.2 Rules for plotting root – locus diagrams

UNIT-9 FREQUENCY RESPONSE

9.1 Frequency response analysis
9.2 Bode and Nyquist stability criteria
9.3 Gain Margin and Phase margin in controller tuning
9.4 Performance criteria – IAE, ISE, IATE, Zeigler – Nichols and Coon – Cohen rules.

UNIT-10 DIGITAL CONTROL SYSYEM

10.1 Fundamentals of digital control
10.2 A/D converters,
10.3 D/A converters Introduction to the Z-transform
10.4 Direct digital Control and Distributed control Systems

UNIT-11 ADVANCED CONTROL STRATEGIES

11.1 Ratio Control
11.2 Cascade control
11.3 Adaptive control

UNIT-12 APPLICATIONS OF PROCESS CONTROL

12.1 Control Strategy for distillation column
12.2 Reactor
12.3 Heat Exchanger

Reference books:

1. Automatic Control Engineering by F H Raven
2. Instrumentation, Measurement and Analysis by B C Nakra and K K Chaudhry