4. **Production / Operations Management,** Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Sub Code	**: 10ME 82**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

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UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, 3rd Ed., TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems**, Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control**, Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System**, Schaum's series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Sub Code	**: 10ME 831**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Tribology: Properties of oils and equation of flow: Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between

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