B. TECH. SEMESTER -III

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Course Code	2EI301
Course Title	Control Theory

Course Learning Outcome:
At the end of the course, students will be able to -

1. apply the basic concept of mathematical modeling for the control system
2. analyze time and frequency response of control system
3. evaluate the stability of linear control system

Syllabus   **Teaching Hours**

UNIT 1: Introduction to Control System.

Introduction, examples of control systems, closed loop control versus open-loop control

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UNIT 2: Mathematical Modeling of Dynamic Systems

Introduction, differential equations for mechanical systems for translation motion, determination of transfer function, Differential equations for rotational motion, determination of transfer function, Transfer function of electrical system, Transfer Functions of mechanical systems & electrical systems with examples.

15

Analogues systems: Force (Torque)- voltage analogy and force(Torque) - current analogy, problems, Signal flow graph, definitions, construction of signal flow graph, Mason's gain formula, use of mason' s gain formula to determine the transfer function, State-space modeling of physical systems, Conversion of transfer function to the state model, Conversion of state model to the transfer function

UNIT 3: Feedback characteristics of control system

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Feedback and non-feedback systems, reduction of parameter variation by use of feedback, Disturbance reduction using feedback control.

UNIT 4 : Time response analysis.

Introduction, Time response of first order systems, Time response of a second order control system, Time response specifications. Derivation of specification, Problems on above topics. Steady state errors and error constants types of feedback control systems.

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UNIT 5: Stability

Concept of stability, absolute stability, absolute stability and relative stability, necessary conditions for stability. Hurwitz stability criterion, Routh stability criterion. Special case of Routh stability criterion. Application of Routh criterion to linear control system. Relative stability analysis using Routh criterion, Limitation of Routh criterion.

4

UNIT 6: Root locus analysis

Introduction to root locus plots, Summary of general rules for constructing root loci,Special cases, root locus analysis of control systems, Stability using root locus

6

UNIT 7: Frequency Response Analysis.

Introduction, bode diagrams, log-magnitude versus phase plots, stability analysis using bode plot polar plots, Nyquist stability criterion, stability analysis

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Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial:

Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

References:

1) Katsuhiko Ogata, Modern Control Engineering, PHI Publication.
2) Nagrath & Gopal, Control System Engineering, New Age International Publication.
3) M.Gopal, Modern Control System Theory, New Age International Publication.
4) Norman S. Nise, Control System Engineering, Wiley Publication.