Department of ECM   **PVP12**

3/4 B.Tech. SIXTH SEMESTER

EM6T6   **Credits: 4**

CONTROL SYSTEMS

Lecture: 4 periods/week   **Internal assessment   : 30 marks**
Tutorial: 1 period /week   **Semester end examination: 70 marks**

Course Objectives:
- **T**o describe concept of feedback control and basic components of control systems and finding of TF for various systems and its analysis.
- Describe the various time domain and frequency domain plots for analysis and design of linear control systems.
- To know the stability of systems from transfer function and state space techniques.

Learning Outcomes:

At the end of this course, the Student will be able to
- Able to know open loop, closed loop control systems & know the concept of transfer function and its significance of analyzing systems.
- Know the stability analysis form time and frequency domain plots like Root locus, Bode , Polar ,Nyquist Plots.
- Know the advance control techniques such as state space and its applications & concepts of controllability, observability.

UNIT – I
INTRODUCTION: Concepts of Control Systems- Classification of control systems , Different examples of control systems ,Open Loop and closed loop control systems , Feed-Back Characteristics, Effects of
feedback.

UNIT-II
MATHEMATICAL MODELLING OF CONTROL SYSTEMS: Concept of Transfer function , Mathematical models – Differential equations, Impulse Response – Finding of Transfer function for mechanical systems , electrical systems and electrical analogous of mechanical systems

UNIT III
TRANSFER FUNCTION REPRESENTATION: Transfer Function of DC Servo motor, AC Servo motor, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra –Representation by Signal flow graph-Overall gain using mason's gain formula.

UNIT-IV
TIME RESPONSE ANALYSIS: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications –Steady state error and error constants

UNIT – V
STABILITY ANALYSIS IN S-DOMAIN: The concept of stability – Routh's stability criterion, limitations of Routh's stability.

Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT – VI
FREQUENCY RESPONSE ANALYSIS: Introduction, Frequency domain specifications-Bode plot and Stability Analysis , transfer function calculation from the Bode Diagram
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UNIT – VII
STABILITY ANALYSIS IN FREQUENCY DOMAIN: Polar Plots,   Nyquist Plots and Stability Analysis.

UNIT – VIII
STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS: Concepts of state, state variables and state model, derivation of state models for mechanical , electrical systems , TF to SS and SS to TF conversion- Solution of state Equations- State Transition Matrix and it's Properties –Concepts of Controllability and Observability

Learning resources

TEXT BOOKS:
1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John wiley and son's.,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International(P) Limited, Publishers, 2nd edition.

REFERENCE BOOKS:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control systems by A. Nagoorkani –RBA Publications , 2 nd edition
3. Control Systems Engg. by NISE 3rd Edition – John wiley
4. " Modelling & Control Of Dynamic Systems" by Narciso F. Macia George J. Thaler, Thomson Publishers