

OBJECTIVES

- To introduce the concept of open loop and closed loop (feedback) systems
- To provide knowledge of time domain and frequency domain analysis of control systems required for stability analysis
- To present the compensation technique that can be used to stabilize control systems

UNIT I CONTROL SYSTEM MODELING**9**

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

UNIT II TIME RESPONSE ANALYSIS**9**

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

UNIT III FREQUENCY RESPONSE ANALYSIS**9**

Frequency Response- Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Series, Parallel, series-parallel Compensators- Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB

UNIT IV STABILITY ANALYSIS**9**

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion- Relative Stability, Analysis using MATLAB

UNIT V STATE VARIABLE ANALYSIS**9**

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems.

TOTAL =45 PERIODS

After successful completion of this course the students will be able to :

- CO1: Develop mathematical models for Electrical and Mechanical Systems (K3 Apply)
- CO2: Analyze the time response of first and second order systems (K4 Analyze)
- CO3: Analyze the LTI system through various frequency response plot (K4 Analyze)
- CO4: Analyze the stability of systems using analytical and graphical methods (K4 Analyze)
- CO5: Analyze MIMO systems using state-space model (K4 Analyze)

TEXT BOOKS /REFERENCE BOOKS

1. J.Nagrath,M.Gopal "Control Systems: Engineering ", Anshan Publishers, 5thEdition, 2008.
2. M.Gopal, "Control Systems: Principles and Design ", Tata McGraw Hill, 4th Edition,2012

REFERENCES

1. M.Gopal, " Digital Control and State Variable Methods ", TMH, 2nd Edition, 2007.
2. Schaum"s Outline Series, " Feedback and Control Systems ", Tata McGraw-Hill, 2007.
3. Richard C. Dorf, Robert H. Bishop," Modern Control Systems ", Addison – Wesley, 9th Edition,2010.
4. Benjamin.C.Kuo , " Automatic control systems ", Prentice Hall of India, 6thEdition ,2013.
5. John J.D"azzo , Constantine H.Houpis , " Linear control system analysis and design ", Tata McGraw-Hill, 1995.