

**EC6405 CONTROL SYSTEM ENGINEERING**

DETAILED SYLLBUS

**OBJECTIVES:**

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems
- To introduce the state variable analysis method

**UNIT I CONTROL SYSTEM MODELING**

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**

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**

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles – Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

**UNIT IV STABILITY ANALYSIS**

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**

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. Sampled Data control systems – Sampling Theorem – Sampler & Hold – Open loop & Closed loop sampled data systems.

**TEXTBOOK:**

1. J.Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

**REFERENCES:**

1. Benjamin.C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.

2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.
3. Schaum"s Outline Series, "Feedback and Control Systems" Tata Mc Graw-Hill, 2007.
4. John J.D"Azzo & Constantine H.Houpis, "Linear Control System Analysis and Design"", Tata Mc Graw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.