EC 331 CONTROL SYSTEMS ENGINEERING 4 credits [3-1-0]

INTRODUCTION; MATHEMATICAL MODEL: Mathematical representation of physical systems, Transfer function and impulse response of linear systems, Block diagram, Signal flow graphs; CONTROL SYSTEM COMPONENTS: Potentiometer, Synchros, LVDT, modulators, demodulators, ac servo motors, ac and dc tacho generators, HYDROULIC SYSTEMS and PNEUMATIC SYSTEMS; GENERAL FEEDBACK THEORY: Feedback, The effect of feedback, Mathematical definition of feedback; TIME RESPONSE OF FEEDBACK CONTROL SYSTEMS: Typical test signal for the transient analysis, time domain performance characteristics, transient response, PI, PD Controllers, Tacho meter feedback, Steady state response, steady state error, The generalized error analysis, Stability, The Routh-Hurwitz criterion; THE FREQUENCY RESPONSE METHOD: Bode's Plot, Frequency domain specifications, M_P and ω_P for a second order system; THE NYQUIST CRITERION AND STABILITY: Nyquist criterion and the GH Plot, Relative stability, gain margin, phase margin, conditionally stable systems; THE ROOT LOCUS TECHNIQUE: Introduction, Root Locii, Root locus of conditionally stable systems; STATE VARIABLE ANALYSIS: Introduction, state, state variable and state model, State equations of continuous data control system, Derivation of state model from transfer functions and Vice-versa. Diagonalisation, solution of state equation.

Essential Readings:

1. K. Ogata, *Modern Control Engineering*, 2001, Prentice Hall of India,.
2. N. S. Nise, *Control system engineering*, 1992, John Wiley & Sons.

Supplementary Readings:

1. B.C. Kuo, *Automatic Control System,1995,* PHI
2. J. Diazzo and C.F. Houpis, Feed back *Control system analysis and synthesis.*