SUBJECT NO-EE31009, SUBJECT NAME- CONTROL SYSTEM ENGINEERING

LTP- 3-1-0,CRD- 4

SYLLABUS :-

Control Systems Engineering1. Introduction and Overview: What is control; Meaning of the terms reference input, control input, disturbance input and controlledoutput; Tracking and the disturbance rejection problems; Manual vs. automatic control; Feedback and feed forward control.2. Modelling: Impulse response and convolution integral for LTI systems; I/O relation in Laplace domain and Transfer function; Block-diagram (and Signal-flow-graph) representation of systems and their reduction to get T/F; Normalized T/F; Some examples.Concept of states; State-space modelling of general systems; Operating points and linearization about the same; State-space to transfer function transformation and the reverse (i.e., realization) problem for LTI systems; Examples of incremental transfer function. 3. Characterization of plants: Asymptotic and BIBO stability; Significance of poles and eigenvalues; Internal stability; Routh-Hurwitz test.Time-domain impulse- and step-responses of 1- and 2-pole systems; Settling time, over-shoot etc. in terms of damping coefficient and natural frequency; Effect of zero near the origin (and in rhp). Definition and significance of Frequency-response;Relation between time- and frequency-response features (of 2-pole plants); Nyquist and Bode plots; Examples.4. Analysis of effects of feedback: Stability analysis of C/L systems from O/L Nyquist and Bode plots;O/L plant - types and C/L steady-state errors for step and ramp inputs; C/L root-loci for variation of loop gain (or other parameter); Sensitivity transfer functions (S and T) and their significance; Measure of loop robustness in terms of the peaks of S and T. 5. Compensation techniques: Performance goals - Steady state, transient and robustness specifications; Time-domain vs. frequency-domain design approaches; PID, Lag-lead, and Pole-placement design techniques; 2 degree-of-freedom control.6. Sampled-data systems: Overview of computer controlled systems; z- transform for discrete time signals and systems; Examples of z-domain transfer functions; Stability and response; Frequency spectrum and Sampling theorem; Aliasing effect and its remedy; Controller design via digital-redesign/root-locus.