

## **EX- 602 – Control Systems**

### **Unit-I**

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Simulation of differential equations in analog computer, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), tachogenerators, power amplifier, stepper motors

### **Unit-II**

Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants Feedback control actions: Proportional, derivative and integral control.

Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix, stability Routh-Hurwitz stability analysis.

### **Unit-III**

Characteristics equation of closed loop system root loci, construction of loci, Effect of adding, poles and Zeros on the loci, Stability by root loci.

### **Unit-IV**

Frequency, Domain analysis, Bode plots, Effect of adding, poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability : Gain and phase margins.

### **Unit-V**

Frequency- Domain compensation : lead lag, Lag-lead compensation, Design of compensating networks

### **References:**

1. I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
2. Modern Control Systems by Roy Chaudhary. PHI
3. K. Ogata, Modern Control Engineering, PHI.
4. B.C. Kuo, Automatic Control systems, PHI
5. Gopal M., Control System : Principles & Design, TMH.
6. Stefani, Shahian, Savant, Hostetter, "Design of feed back control System's", Oxford.
7. Krishna. K. Singh & Gayatri Agnihotri, System Design through MATLAB control tool & Simulink, Stringer Verlag, U.K.
8. Rudra Pratap, Getting Started with MATLAB, Oxford.
9. Dhanesh N.Manik, Control Systems, CENGAGE Lea