**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**Electrical & Electronics Engineering, IV-Semester**

**EX 405 Control System**

**UNIT 1:**
Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Laplace Transform, 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), tacho-generators, power amplifier, steeper motors.

**UNIT 2:**
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.
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**UNIT-3:**
Stability: Routh-Hurwitz stability analysis 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-4:**
Frequency, Domain analysis, Bode plots, Effect of adding, poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability: Gain and phase margins.

**UNIT-5:**
Design of control systems with PD/PI/PID Control in time domain and Frequency domain, lead-lag, Lag-lead compensation, Design of compensating networks. Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix


**List of experiments (Expandable)**

1. Time response of second order system.
2. Characteristics of Synchros.
3. Effect of feedback on servomotors.
4. Determination of transfer function of A-C servomotor
5. Determination of transfer function of D-C motor.
6. Formulation of PI & PD controller and study of closed loop responses of 1st and 2nd order dynamic systems.
7. State space model for classical transfer function using MATLAB.
8. Simulation of transfer function using operational amplifier.
9. Design problem: Compensating Networks of lead and lag.
10. Temperature controller using PID.

11. Transfer function of a DC generator.
12. Characteristics of AC servomotor.
13. Use of MATLAB for root loci and Bode plots of type-1, type-2 systems.
14. Study of analog computer and simulation of 1st orderand 2nd order dynamic   equations.
15. Formulation of proportional control on 1st order and 2nd    order dynamic systems.
16. Feedback control of 3rd  order dynamic  Systems
17. Study of lead and lag compensating networks.
18. Effect of adding poles & zeros on root loci and bode plots of type-1, type-2 systems through MATLAB.

**REFERENCES**

1. B.C. Kuo and FaridGolnaraghi, 'Automatic Control Systems', Wiley India.
2. M. Gopal, 'Control system engineering', McGraw Hill
3. K. Ogata, 'Modern Control Engineering', Pearson
4. D. Roy, Chaudhary,'Modern Control Systems', PHI.
5. S. Salivahanan, R. Rengaraj, G.R. Venkatakrishnan, 'Control System Engineering', Pearson.
6. Stefani ShahianSavant,Hostetter, 'Design of feedback control systems' Oxford
7. B.S.Manke, Control system Engineering, Khanna Publishers