

S.E. (ELECTRONICS) SEMESTER III

CONTROL SYSTEM ENGINEERING

Period per week	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	2	---
	Oral Examination	---	25
	Term Work	---	25
	TOTAL	---	150

Detailed Syllabus		Lectures/Week
1	<p>Introduction to control system analysis Introduction, examples of control systems, open loop control systems, closed loop control systems. Transfer function. Types of feed back & feed back control system characteristics – noise rejection, gain, sensitivity, stability.</p>	06
2	<p>Mathematical modeling of systems Importance of a mathematical model, Block diagrams, signal flow graphs, Mason's gain formula and its application to block diagram reduction. State space method, solving time-invariant system, transfer matrix.</p>	09
3	<p>Transient & steady state - Response Analysis 3.1 Impulse response function, First order system, second order system, time domain specifications of systems, analysis of transient-response using Second order model. 3.2. Classification of control systems according to "Type" of systems, Steady – state errors, static error constants, Steady – state analysis of different types of systems using step, ramp and parabolic input signals.</p>	12
4	<p>Stability Analysis Introduction to concept of stability, Stability analysis using Routh's stability criterion, Absolute stability, Relative stability. Root-Locus plots, summary of general rules for constructing Root- Locus, Root-Locus analysis of control</p>	09

	systems. Compensation techniques-Log, lead, log-lead.	
5	Frequency-Response Analysis Introduction, Frequency domain specifications, resonance peak and peak resonating frequency, relationship between time and frequency domain specification of systems. Bode plots, Polar plots, Log–magnitude Vs phase plots, Nyquist stability criterion, stability analysis, Relative stability, gain margin, phase margin, stability analysis of system using Bode plots. Closed-Loop Frequency Response-Constant gain and phase loci, Nichol’s chart and their use in stability study of systems.	09
6	Control components & Controller DC and AC servomotors, servoamplifier, potentiometer, synchro transmitters, synchro receivers, synchro control transformer, stepper motors. Discontinuous controller modes, continuous controller modes, composite controllers.	09

Textbooks:

1. J Nagrath, M Gopal, Control system Engineering, Tata McGraw Hill
2. K. Ogata, Modern Control Engineering, Pearson education, third edition.
3. Benjamin C. Kuo, Automatic Control Systems, Pearson education, seventh edition.

Reference Books:

1. Madan Gopal, Control Systems Principles and Design, Tata McGraw Hill, seventh edition, 1997.
3. Nise, control system Engineering, John wiley & sons, 3rd edition
4. Curtis Johnson, Process Control Instrumentation Technology, Pearson education, fourth edition.

Termwork:

The Termwork shall consist of at least ten experiments and three assignments based on the whole syllabus, duly recorded and graded. This will carry a weightage of fifteen marks. A test shall be conducted and will carry a weightage of ten marks.

SUGGESTED LIST OF EXPERIMENTS

Laboratory / Simulations

1. Transient response of 1st order & 2nd order system
2. Frequency response of 1st order & 2nd order system
3. Steady state error analysis of different types of systems

4. D.C. servomotor
5. A.C. servomotor
6. Synchro Transmitter and Receiver
7. Potentiometer

Simulation

1. Block diagram reduction
2. Time response analysis
3. Frequency response analysis
4. Stability analysis

