

**S.E. (ELECTRONICS) SEMISTER- III**  
**CONTROL SYSTEM ENGINEERING**

Period per week	Lectures	04	
	practical	02	
	Tutorial	--	
		<b>Hours</b>	<b>Marks</b>
Evaluation System	Theory Examination	3	100
	Practical	2	---
	Oral Examination	---	25
	Term Work	---	25
	TOTAL		150

Detailed Syllabus		Lect./W eek
1	<b>Introduction to control Analysis</b> Introduction, Examples of control systems, Open loop control Systems, Closed loop control Systems, Transfer function. Types of Feedback & Feedback control System Characteristics –Noise Rejection, Sensitivity, and Stability.	06
2	<b>Mathematical modeling of Systems</b> Importance of a Mathematical Model, Block Diagrams, Signal flow Graphs, Masan’s gain formula and its application to block diagram reduction. State space method, Solving time- invariant system, Transfer Matrix.	09
3	<b>Transient &amp; steady state – Response Analysis</b> 3.1 Impulse response function, First order system, Second order system, Time domain specification of systems, Analysis of transient response using second order model. 3.2 Classifications 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.	12
4	<b>Stability Analysis</b> Introduction to constant 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 systems. Compensation techniques- Log, Lead, log-lead.	09
5	<b>Frequency – Response Analysis</b> Introduction, Frequency domain specification, resonance peak and peak resonating frequency, Relationship between time and frequency domain specification of systems. Bode	09

	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.	
6	<b>Control components and Controller</b> DC and AC servomotors, servo amplifier, potentiometer, synchro Transmitters, synchro receivers, synchro control Transformer stepper motors. Discontinuous controller modes, continuous controller modes, composite controllers.	09

**Textbooks:**

1. J. Nagrath, M. Mogal, Control system Engineering, Tata McGraw Hill.
2. K. Ogata. Modern Control Engineering, Pearson education, Third Edition.
3. 2. 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.
2. Nise control system Engineering, John wiley & Sons. 3<sup>rd</sup> Edition.
3. 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 1<sup>st</sup> order and 2<sup>nd</sup> order system.
2. Frequency Response of 1<sup>st</sup> order and 2<sup>nd</sup> order system.
3. Steady state error analysis of different types of systems.
4. D. C. Servomotors.
5. A. C. Servomotors.
6. Synchro Transmitter and receiver.
7. Potentiometer.

### Simulation

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