

Control System Engineering

S.E. Sem. III [ETRX]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Introduction to Control System Analysis

Introduction, examples of control systems, open loop control systems, closed loop control systems, Transfer function. Types of feedback and feed back control system characteristics – noise rejection, gain, sensitivity, stability.

2. Mathematical Modeling of Systems

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.

3. Transient and Steady State – Response Analysis

- Impulse response function, first order system, second order system, time domain specifications of systems, analysis of transient-response using second order model.
- 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.

4. 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 systems. Compensation techniques-Log, Lead, log-lead.

5. Frequency Response Analysis

Introduction, Frequency domain specification, 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.

6. Control components and Controller

DC and AC servomotors, servoamplifier, potentiometer, synchro transmitters, synchro receivers, synchro control transformer, stepper motors. Discontinuous controller modes, continuous controller modes, composite controllers.

Reference :

1. Control system Engineering (*J. Nagrath*) – Tata McGraw Hill.
2. Modern Control Engineering (*K. Ogata*) – Pearson education, third edition.
3. Automatic Control Systems (*Benjamin C. Kuo*) – Pearson education, seventh edition.
4. Control Systems Principles and Design (*Madan Gopal*) – Tata McGraw Hill, seventh edition, 1997.
5. Control System Engineering (*Nise*) – John Wiley & Sons, 3rd edition.
6. Process Control Instrumentation Technology (*Curtis Johnson*) – Pearson education, fourth edition.

