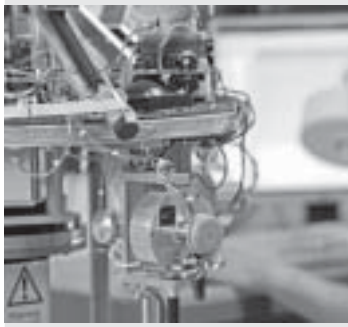
19EC215 CONTROL SYSTEMS



SOURCE:
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Hours Per Week :

L	T	P	C
3	-	-	3

PREREQUISITE COURSES: Engineering Mathematics - I (E);
Engineering Mathematics - II (E).

COURSE DESCRIPTION AND OBJECTIVES:

To get acquaintance with the mathematical modelling of the physical systems.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes.

COs	Course Outcomes
1	Apply mathematical modeling to the physical systems/electrical systems.
2	Analyze the response of the open and closed loop systems intime domain.
3	Design lag, lead and lead-lag compensators and PID controllers.
4	Investigate the stability of a given control system by using RH, Root locus, Bode plot and Nyquist plot.

SKILLS:

- ✓ *Model any physical system.*
- ✓ *Determine overall transfer function of a system using block diagram reduction tech nique and SFG method.*
- ✓ *Analyze first and second order systems in time domain.*
- ✓ *Determine design specifications like rise time, settling time, steady state error.*
- ✓ *Analysis of stability using R-H Criterion.*
- ✓ *Determine open loop gain variation in a stable system using root locus method.*
- ✓ *Stability analysis of any system in the frequency domain.*
- ✓ *Design of lag, lead compensators using R, L and C for any linear time invariant system.*

UNIT - I **L-9**

INTRODUCTION TO CONTROL SYSTEMS: Introduction, Concept of control systems, Open loop versus closed loop control systems, Different examples of control systems, Classification of control systems, Transfer function and block diagram representation of systems considering electrical systems as examples, Block diagram algebra, Signal flow graph representation, Reduction using Mason's gain formula.

UNIT - II **L-9**

TIME RESPONSE ANALYSIS AND STABILITY: Time response analysis, Standard test signals, Time response of first order systems, Characteristic equation of feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants.

UNIT - III **L-9**

STABILITY ANALYSIS - 1: Stability - the concept of stability, routh stability criterion; Root locus technique - the root locus concept, construction of root loci.

UNIT - IV **L-9**

STABILITY ANALYSIS - 2: Frequency response analysis - introduction, frequency domain specifications, bode diagrams, phase margin and gain margin, stability analysis from bode plots, polar plots, nyquist plots and nyquist stability criterion.

UNIT - V **L-9**

DESIGN AND MODERN CONTROL SYSTEMS: Preliminary design considerations, Realization of basic compensators - lead, lag and lead-lag; State space analysis of continuous systems - concepts of state, state variables and state model, solving the time invariant state equations, state transition matrix, controllability and observability.

TEXT BOOKS:

1. J. Nagrath and M. Gopal, "Control Systems Engineering", 2nd edition, New Age International (P) Limited, 2009.
2. Katsuhiko Ogata, "Modern Control Engineering", 5th edition, Prentice Hall of India Private Ltd, New Delhi, 2011.

REFERENCE BOOKS:

1. M. Gopal, "Control Systems: Principles and Design", 3rd edition, McGraw Hill, 2008.
2. Benjamin C Kuo and Farid Golnaraghi, "Automatic Control systems", 9th edition, Prentice Hall of India Private Ltd, New Delhi, 2009.
3. Richerd C. Dorf and Robert H. Bishop, "Modern Control Systems", 12th edition, Prentice, Hall, 2010.
4. S.Salivahanan, R.Rengaraj and G.R. Venkata Krishnan, "Control Systems Engineering", 1st edition, Pearson, 2015.