NIRMA UNIVERSITY
Institute of Technology
B.Tech. in Electrical Engineering
Semester – IV

L	T	P	C
2	0	2	3

Course Code	2EE401
Course Title	**Control Systems Engineering**

Course Learning Outcomes (CLO):

At the end of the course, students will be able to-

1. develop mathematical model of Linear Time Invariant (LTI) System
2. understand behavior of LTI System in time and frequency domain
3. understand design of controller
4. understand state space representation of LTI system and concept of controllability & observability.

Syllabus: **Teaching Hours: 30**

Unit-1: Introduction to control problem   **05**

Mathematical model of physical analogous system, Transfer function model of linear time invariant (LTI) system, open loop and closed loop systems, effects of feedback, block diagram reduction technique and introduction to signal flow graphs.

Unit-2: Time response analysis   **06**

Standard test signals. Time response of first and second order systems and their design specifications. Concept of stability, Routh and Hurwitz criterion for stability assessment, Root-locus.

Unit-3: Frequency response analysis   **06**

Concept of frequency response, frequency domain design specifications, construction of Bode plot and polar plot. Nyquist criterion, Relative stability using Nyquist criterion.

Unit-4: Design of controller   **06**

Design of controller using root-locus, design of controller using frequency domain techniques, design of robust control system.

Unit-5: State variable techniques   **07**

Concept of state and state variables, state space modelling, solution of state equations, conversion between state space and transfer function model, Concept of controllability and observability, Pole placement by state feedback.

Self-Study Component:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Experiments:

This shall consist of at least 10 experiments / simulations based on the above syllabus.

References:

1. Norman S. Nise, Textbook of Control Systems Engineering Vol – I, John-Wiley, New York.
2. Nagrath I.J & M. Gopal, Textbook of Control System Engineering, New Age International (I) Ltd.
3. M.Gopal, Digital Control and State Variable Methods, TMH Publication, New Delhi.
4. Benjamin C. Kuo, Textbook of Automatic Control Systems, Prentice Hall of India, New Delhi.
5. K. Ogata, Textbook of Modern Control Systems, K. Ogata, Prentice Hall of India, New Delhi.
6. U. A. Patel, Textbook of Control Systems Engineering, Mahajan Publishing House, Ahmedabad.
7. R. C. Dorf, Textbook of Modern Control Systems, Pearson Education India Ltd.
8. G Franklin, J. D. Powell, Textbook of Feedback Control of Dynamic Systems, Addison Wesley.
9. J. C. Doyle, B. A. Francis, Textbook of A. R. Tannenbaum, Feedback Control Theory, Maxwell-McMilan International Edition.
10. C. L. Phillips, R. D. Harbour, Textbook of Feedback Control Systems, Prentice Hall

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2019-20 and onwards