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

L	T	P	C
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Course Code	**2EEDE02**
Course Title	**Modern Control Theory**

Course Outcomes (COs):

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

1. make state space model of continuous and discrete time LTI system
2. design controller and assess stability of LTI system
3. comprehend concept of state observer and its design
4. apply methods for analysis of non – linear systems

Syllabus: **Teaching Hours: 45**

Unit-1: State space modelling of electrical system **06**

State space representation, state equations for dynamic systems, state space modelling of electrical systems. Conversion from state space to transfer function and transfer function to state space model, Solution of state equations, State transition matrix, Linearization of non-linear models.

UNIT-2: Controllability and observability **12**

Necessary and sufficient conditions of controllability, Controller design using pole placement method, Linear state regulator design, Observability of state space model, Decomposition of variables into controllable and uncontrollable components.

Unit-3: Stability assessment and state observer design **10**

Concept of Lyapunov stability, Energy function and stability assessment, Limit cycle in nonlinear system, Design of full order observer and reduced order observer, Decomposition of state into observable and unobservable components.

Unit-4: Discrete time system **12**

Time domain model of discrete time system, Controllability and observability of discrete time system, Stability of discrete time system.

Unit-5: Nonlinear Systems **05**

Nonlinear systems with separable nonlinearities like saturation, dead zone and nonlinear friction. Describing function of nonlinearity, stability analysis by describing function method.

Self-Study:

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

Suggested Readings:

1. M. Gopal, Modern Control System Theory, New Age Publishers
2. William Brogan, Modern Control Theory, Pearson Publications.
3. Richard Dorf, Modern Control Systems, Prentice Hall.

4. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall.
5. Katsuhiko Ogata , State space analysis of control systems, Prentice Hall
6. Hassan Khalil, Nonlinear control using MATLAB, Pearson Publications
7. Slotine, Applied nonlinear control, Prentice Hall

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

w.e.f. academic year 2020-21 and onwards