**20EE32E3-MODERN CONTROL THEORY**

**(EEE)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Control systems, circuits and networks, Mathematics | **Sessional Evaluation:**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

|  |  |  |
| --- | --- | --- |
| **Course Objectives:** | Students undergoing this course are expected to learn : | |
| 1.To derive mathematical models of typical engineering processes  2. To provide basic knowledge of control system analysis and design  tools.  3.To Introduce the concepts of controllability and observability  4. To provide knowledge on analysis of non-linear systems using  describing function analysis  5. To analyze non-linear systems using Liapunov function and design  Liapunov functions  6. To provide basic knowledge on controllers and compensators design. | |
| **Course Outcomes:** | Upon successful completion of the course , the students will be able to: | |
| **CO1** | Design compensators. |
| **CO2** | Design P, PI and PID controllers |
| **CO3** | Perform different system representations and examine the system controllability and observability |
| **CO4** | Understand the concept of state transition matrix and design state feedback controller and observer. |
| **CO5** | Enumerate the basic idea of non-linearities and stability analysis. |
| **CO6** | Apply different techniques for non-linear systems stability analysis |
| **Course Content:** | **UNIT-I**  **Linear system design:** Introduction of compensating networks, lead, lag, lead, lag cascade compensation in time-domain, feedback compensation.  **UNIT-II**  **Design of controllers:** P, PI and PID controllers design using Bode plot and Root locus techniques.  **UNIT-III**  **State variable analysis:** system representation in state variable form, phase variable representation, diagonalization, canonical variable representation.  **Controllability and observability:** Definition of controllability, controllability tests for continuous time systems, definition of observability, observability tests for continuous time systems.  **UNIT – IV**  **Time response of linear systems:** Introduction, solution of state equations, state transition matrix, sylvester’s expansion theorem, pole placement by state feedback, full order and reduced order observers.  **UNIT – V**  **Non-linear systems:** Introduction, common physical non linearities, singular points, basic concepts and derivation of describing functions. stability analysis by describing function method.  **UNIT – VI**  **Stability:** Introduction, equilibrium points, stability concepts and definitions stability in the sense of liapunov stability of linear system, methods of constructing liapunov functions for non-linear system, krasovskii’s method, variable gradient method. | |
| **Text books**  **&**  **Reference books:** | **Text books:**  1. “Control systems engineering”, by I.J.Nagrath and M.Gopal, New age  International publishers.  2. “Modern control system theory”, by M.Gopal, TMH publishers.  3. “Advanced Control Theory”, by A.NagoorKani, 2nd Edition, RBA  Publication.  **Reference books:**  1.“Discrete Time Control Systems”, by Ogata. K, 2nd Edition, Pearson  Publication.  2. “State functions and linear control systems”, by Schultz and Melsa  3. “Control system Engineering”, by NISE, Wiley, 2000.  4. “Modern control systems”, by Richard. C. Dorfand. R. H. Bishop  Addison Wesley longman. | |
| **e-Resources:** | <http://nptel.ac.in/courses>  <http://iete-elan.ac.in>  http://freevideolectures.com/university/iitm | |