**20EE3101-CONTROL SYSTEMS**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basic knowledge of differentiation, integration and Laplace transform techniques. | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn : | |
| 1. The various types of control systems and methods to obtain transfer  function.  2. The mathematical models of physical systems.  3. The time domain response and evaluate stability of control system using  different techniques.  4. The frequency domain techniques to assess the system performance.  5. The different types of compensators for linear systems.  6. The state variable representation of physical systems | |
| **Course Outcomes:** | Upon successful completion of the course , the students will be able to: | |
| CO1 | Understand the various types of control systems and methods to obtain transfer function. |
| CO2 | Develop mathematical models of physical systems. |
| CO3 | Determine the time domain response and evaluate stability of control system using different techniques. |
| CO4 | Apply frequency domain techniques to assess the system performance. |
| CO5 | Design the different types of compensators for linear systems. |
| CO6 | Derive the state space model of a given physical system and solve the state equations. |
| **Course Content:** | **UNIT-I**  **Introduction to classical control systems:** Open loop and closed loop control systems, types of feedback, feedback and its effects, Transfer functions, Block diagram reduction techniques, signal flow graphs.  **UNIT-II**  **Mathematical modeling of physical systems:** Mathematical modeling and transfer functions of electrical, mechanical and electro-mechanical elements, DC servo motors, two-phase AC servo motors, synchros.  **UNIT-III**  **Time domain analysis:**  Introduction, standard test signals, time response specifications, steady state error constants.  **Stability of control systems:** Routh - Hurwitz criterion, Root locus construction, rules for the construction of root loci, introduction to P, PI and PID controllers.  **UNIT-IV**  **Frequency domain analysis:** Introduction, frequency domain specifications, Polar plots, Bode plots, Nyquist stability criterion.  **UNIT-V**  **Design of compensators:** Introduction, need for compensators, lag, lead and lead-lag compensators design in frequency domain.  **UNIT-VI**  **State Space analysis of continuous systems:** Concepts of state, state variables and state model, derivation of state models from block diagrams, Solution of State equations for Homogeneous and Non homogeneous systems (Derivation only), State Transition Matrix and it’s properties, concepts of Controllability and Observability. | |
| **Text books**  **&**  **Reference books:** | **TEXT BOOKS:**  1. “Control system engineering”, by I.J.Nagrath and M.Gopal, 6th Edition, New Age International (P) Ltd.  2. “Control systems”, by A.Nagoorkani, 2nd Edition, RBA publishers.  3. “Control systems”, by A.Anand kumar, 2nd Edition, PHI publishers.  **REFERENCE BOOKS:**  1. “Automatic control systems”, by B.C.Kuo, 7thEdition, PHI publishers.  2. “Discrete time control systems”, by K.Ogata, PHI Publishers.  3. “Control systems engineering”, by Norman S Nise, Wiley, 2000. | |
| **e-Resources:** | <http://nptel.ac.in/courses>  <http://iete-elan.ac.in>  <http://freevideolectures.com/university/iitm> | |