**19EE42E1- DIGITAL CONTROL SYSTEMS**

**(EEE)**

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Control Systems, Signals & Systems, Laplace Transforms and Z Transforms. | **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 concepts of digital control systems. 2. The theory of z–transformations and application for the mathematical analysis of digital control systems. 3. To represent the discrete–time systems in state–space model and evaluation of state transition matrix. 4. To examine the stability of the system using different tests. 5. The conventional method of analyzing digital control systems in the w–plane. 6. The design of state feedback control by “the pole placement method. | |
| **Course Outcomes:** | After completing the course the student will be able to: | |
| **CO1** | Understand discrete time control systems and the “knowhow” of various associated accessories. |
| **CO2** | Demonstrate Z–transformations and their role in the mathematical analysis of different systems. |
| **CO3** | Design the state feedback control by the pole placement method. |
| **CO4** | Apply the stability criterion for digital systems and methods adopted for testing. |
| **CO5** | Represent the discrete–time systems in state–space model and evaluation of state transition matrix. |
| **CO6** | Design the conventional and state space methods of design. |
| **Course Content:** | **UNIT-I**  **Introduction and signal processing:** Introduction to analog and digital control systems, advantages of digital systems, typical examples, signals and processing, sample and hold devices, sampling theorem and signal reconstruction, frequency domain characteristics of zero order hold.  **UNIT-II**  **Z–transformations:** Z–Transforms, theorems, finding inverse Z–transforms, formulation of difference equations and solving, block diagram representation, pulse transfer functions and finding open loop and closed loop responses.  **UNIT-III**  **State space analysis and the concepts of controllability and observability:** State space representation of discrete time systems, state transition matrix and methods of evaluation, discretization of continuous, time state equations, concepts of controllability and observability, tests(without proof).  **UNIT- IV**  **Stability analysis:** Mapping between the s-plane and the Z-plane –, primary strips and complementary strips, stability criterion, modified routh’s stability criterion and jury’s stability test.  **UNIT-V**  **Design of digital control system:** Design of discrete PID controller, design of discrete state feedback controller, design of set, point tracker, design of discrete observer for LTI system, design of discrete compensator.  **UNIT-VI**  **Discrete output feedback control:** Design of discrete output feedback control, fast output sampling (FOS) and periodic output feedback controller design for discrete time systems. | |
| **Text books**  **&**  **Reference books:** | **Text books:**  1.“Discrete–time control systems”, by K. Ogata, Pearson  Education/PHI, 2nd Edition.  2. “Digital control engineering”, M. Gopal, Wiley Eastern, 2nd Edition.  3.“Digital control of dynamic systems”, by G. F. Franklin, J. D. Powell  and M. L. Workman, Addison-Wesley, 3rd Edition.  **Reference books:**  1.“Digital control engineering”, by M. Sami Fadali Antonio Visioli,  Elsevier Limited, Oxford, 2nd Edition, 2012.  2.“Digital Control and State Variable Methods”, by M.Gopal, TMH,  4th Edition.  3.“Digital Control System”, by B.C. Kuo, Holt, Rinehart and Winston,  2nd Edition. | |
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