

Course code	Course Name	L-T-P -Credits	Year of Introduction
EE462	Design of Digital Control Systems	3-0-0-3	2016
<b>Prerequisite: Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To introduce the need and concept of digital control system.</li> <li>To impart knowledge about different strategies adopted in the design of digital controllers.</li> <li>To familiarize with the design of different types of digital controllers.</li> </ul>			
<b>Syllabus</b>			
Basic digital control system-Pulse transfer function-Digital PID controller design- compensator design using frequency response - compensator design using root locus - Direct design-method of Ragazzini - Dead-beat controller design - State space analysis and controller design.			
<b>Expected outcome.</b>			
On successful completion, the students will have the ability to			
<ol style="list-style-type: none"> <li>design digital controllers.</li> <li>analyse discrete time system using state space methods.</li> <li>analyse the stability of discrete time system.</li> </ol>			
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>Benjamin C. Kuo, Digital Control Systems, 2/e, Saunders College Publishing, Philadelphia, 1992.</li> <li>C. L. Philips, H. T. Nagle, Digital Control Systems, Prentice-Hall, Englewood Cliffs, New Jersey, 1995.</li> <li>M. Gopal, Digital Control and State Variable Methods, Tata McGraw-Hill, 1997</li> <li>Ogata K., Discrete-Time Control Systems, Pearson Education, Asia.</li> </ol>			
<b>References:</b>			
<ol style="list-style-type: none"> <li>Constantine H. Houppis and Gary B. Lamont, Digital Control Systems Theory, Hardware Software, McGraw Hill Book Company, 1985.</li> <li>Isermann R., Digital Control Systems, Fundamentals, Deterministic Control, V. I, 2/e, Springer Verlag, 1989.</li> <li>Liegh J. R., Applied Digital Control, Rinchart &amp; Winston Inc., New Delhi.</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	Sem. Exam Marks
I	Basic digital control system- Examples - mathematical model-ZOH and FOH- choice of sampling rate-principles of discretization - Mapping between s-domain and z-domain	7	15%
II	Pulse transfer function- Different configurations for the design- Modified z-transform-Time responses of discrete data systems-Steady state performance.	7	15%
<b>FIRST INTERNAL EXAMINATION</b>			
III	Digital PID and Compensator Design: Design of digital PID controller, Design of lag, lead compensators - based on frequency response method.	7	15%
IV	Digital Controller Design: Design based on root locus in the z-plane, direct design - method of Ragazzini. Dead-beat response design- Deadbeat controller.	7	15%
<b>SECOND INTERNAL EXAMINATION</b>			
V	State variable model of discrete data systems -Various canonical form representations-controllable, observable, diagonal and Jordan forms- Conversion from state space to transfer function -Computation of state transition matrix using Cayley-Hamilton theorem and z-transform method	7	20%

<b>VI</b>	Digital state feedback controller design: Complete state and output Controllability, Observability, stabilizability and reachability - Loss of controllability and observability due to sampling.Pole placement design using state feedback for SISO systems.	7	20%
<b>END SEMESTER EXAM</b>			

**QUESTION PAPER PATTERN:**

Maximum Marks: 100

Exam Duration: 3Hours.

**Part A:** 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

**Part B:** 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

**Part C:** 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

**Part D:** 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

