

## ECE 420 – DIGITAL CONTROL SYSTEMS

<b>Type (check one):</b>	Required: _____ Elective: <u> X </u>
<b>2005-2006 Catalog Data:</b>	ECE 420. Digital Control Systems. (Formerly EE 420) Analysis of discrete time systems, sampled-data systems, and digital systems. Development of Z transforms and pulse-transfer functions. Characterization of dynamic response of D/A-A/D conversion, sampling, aliasing. Elements of the design of digital feedback control systems. Transform techniques. Design using control system specifications and root loci diagrams. State variable methods. Introduction to random processes and modern filtering. Effects of quantization. Prerequisite: ECE 322. <i>One semester; three credits.</i>
<b>Prerequisites:</b>	ECE 322
<b>Co-Requisites:</b>	None
<b>Textbook:</b>	Katsuhiko Ogata, Discrete-Time Control Systems, Second Edition, Prentice Hall, 1994.
<b>Other Required Materials:</b>	None
<b>Other References:</b>	Instructor's Notes
<b>Instructor:</b>	Dr. Robert L. Drake, Professor of Electrical and Computer Engineering
<b>Course Objectives:</b>	<ol style="list-style-type: none"><li>1. Prepare students to analyze and design control systems with computers as components in the control loops.</li><li>2. Introduce students to control systems subject to noise in the process and measurements and to apply modern filtering methods.</li></ol>
<b>Prerequisites by Topics:</b>	<ol style="list-style-type: none"><li>1. Laplace transform analysis</li><li>2. Linear feedback controls</li><li>3. Root Locus methods</li><li>4. Bode methods</li></ol>
<b>Topics:</b>	<ol style="list-style-type: none"><li>1. Introduction to computer control systems</li><li>2. Discrete time systems and the Z transform</li><li>3. Sampling and reconstruction</li><li>4. Open loop discrete time systems</li><li>5. Closed loop systems</li><li>6. System time response characteristics</li><li>7. Stability analysis techniques</li><li>8. Digital controller design using root locus and Bode methods</li><li>9. State-space design</li><li>10. Introduction to random variables and Kalman filtering</li><li>11. Hardware project</li></ol>
<b>Class Schedule:</b>	Two 75-minute sessions per week

**Prepared by:** Robert L. Drake, Ph.D., P.E. **Date:** October 2005

**Professional Component:  
ECE 420 – DIGITAL CONTROL SYSTEMS**

Category (check one)	<input type="checkbox"/> Math/Basic Science <input checked="" type="checkbox"/> Engineering <input type="checkbox"/> General Education <input type="checkbox"/> Other
Design (check one)	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Some <input type="checkbox"/> None
Realistic Constraints (check all that apply)	<input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input type="checkbox"/> Sustainability <input type="checkbox"/> Manufacturability <input type="checkbox"/> Ethical <input type="checkbox"/> Health & Safety <input type="checkbox"/> Social <input type="checkbox"/> Political

**Relationship to Program Outcomes:**

Check all that apply:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice