University of Macau

Faculty of Science and Technology

Department of Electrical and Electronics Engineering

Part A: Course Outline

Course Title:	Computer and Microprocessor Control Systems		
Course Code:	ELEC 409	Year of Study:	3
Compulsory/Elective:	Elective		
Course Prerequisites:	ELEC 313		
Prerequisite Knowledge	Classical Control Theory		
Class/Laboratory Schedule:	Theory class: 3 hours; Tutorial/Practice class: 1 hour (per week)		
Duration	One semester	Credit Units	3.5
Text Books and References:	[1] "Digital Control of Dynamic Systems," G.F. Powel, J.D. Powell and M.L. Workman, Prentice Hall, 3rd ed., 2003. [2] "Discrete Time Control Systems," K. Ogata, 2nd ed., Prentice-Hall, 1995. [3] "Computer-Controlled Systems: Theory and Design", K.J. Åström and B. Wittenmark, Prentice Hall, 3rd ed., 1997. [4] "Modern Control Systems," R.C. Dorf and R.H. Bishop, 11th ed., Prentice-Hall, 2008. [5] "Discrete Time Control Problems: Using MATLAB and the Control System Toolbox," J.H. Chow, D.K. Frederick and N.W. Chbat, Thomson Learning, 1st ed., 2003.		
Course Description:	This is an introductory course on digital control theory. It emphasizes a discrete-time viewpoint for the analysis of dynamical systems and the synthesis of control laws meeting given design specifications. Main contents include basic concepts of computer control systems and digital control theory, z-transform, discrete and sampled-data systems, design using transform techniques, digital control system simulation using Matlab/Simulink and Control Toolbox.		
Topics Covered	1. Introduction to computer and microprocessor control systems and digital control theory; 2. Sampling and reconstruction of signals, Z-transform, discrete-time models for sampled-data systems; 3. Time domain and z-domain analysis of sampled-data systems, stability analysis, performance of sampled-data second-order systems; 4. Design of digital control systems using transform techniques; 5. Digital control system simulation using Matlab/Simulink and Control Toolbox.		
Course Objectives:	1. Introduce to students some computer-controlled systems with digital control theory. [a, e, k] 2. Introduce to students discrete-time models for sampled-data systems. [a, e, k]		

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<tr><td></td><td>3. Introduce students to analysis of digital control systems. [a, b, e, k]
4. Introduce students to design of digital control systems. [a, b, c, e, k]
5. Learning to apply course material to improve thinking, problem solving, and making. [a, b, c, e, k]</td></tr>
<tr><td>Course Assessment:</td><td>Assignments : 10%
Quiz :15%
Lab Experiments: 15%
Mid-term Exam: 20%
Final Exam. : 40%</td></tr>
<tr><td>Relationship to Program Objectives and Outcomes</td><td>This course primarily contributes to EEE program outcomes that develop students abilities to:
a. Ability to apply knowledge of mathematics, science and engineering.
c. Ability to design a system, component or process to meet desired needs.

This course secondarily contributes to EEE program outcomes that develop students abilities to:
b. Ability to design and conduct experiments.
e. Ability to identify, formulate and solve engineering problems.
k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.</td></tr>
<tr><td>Course Contents and Relationship to Program Criteria:</td><td>
<table>
<tr><th>Week no.</th><th>Topics</th><th>Program Criteria</th></tr>
<tr><td>1</td><td>Introduction
Basic concepts, history and examples of computer-controlled systems and digital control theory</td><td>CS, ES</td></tr>
<tr><td>2</td><td>Sampling and Sampled-Data Systems
Sampling and reconstruction of signals, z-transform, discrete-time models for sampled-data systems</td><td>DIC, CS, ES, DE, CV</td></tr>
<tr><td>4</td><td>Sampled-Data System Analysis
Time domain and z-domain analysis of sampled-data systems, stability analysis, performance of sampled-data second-order systems</td><td>DIC, CS, ES, DE, CV</td></tr>
<tr><td>5</td><td>Design of Digital Control Systems Using Transform Techniques
Design by emulation, direct design by root locus in the z-plane, frequency response methods, closed-loop systems with digital computer compensation</td><td>DIC, CS, ES, DE, CV</td></tr>
<tr><td>2</td><td>Matlab CAD tools and Lab Experiments</td><td>CS, ES</td></tr>
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<tr><td>Contribution of Course to meet the professional component:</td><td>This course prepares students to work professionally in the area of computer control systems and the related fields. Students should be able to apply knowledge of mathematics and engineering, and skills of digital control techniques, to the analysis and design of computer and microprocessor control systems to meet desired needs.</td></tr>
<tr><td>Course Instructor(s):</td><td>Dr. Feng Wan</td></tr>
<tr><td>Prepared by:</td><td>Dr. Feng Wan</td></tr>
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Part B: General Course Information and Policies

Instructor: Dr. Feng Wan Office: N423

Office Hour: Tuesday 3:30 ~ 6:30 p.m. or by appointment Phone: 4473

E-mail: fwan@umac.mo

Program Criteria Policy:

Course VS Program Criteria

Scale: 1 (Highest) to 4 (Lowest)

Course	PS	DIC	BS	CS	ES	DE	LA	CV	DM
Computer and Microprocessor Control Systems		2		3	1	3		4	

Terms:

Probability and Statistics (PS), Differential and Integral Calculus (DIC), Basic Science (BS), Computer Science (CS), Engineering Science (ES), Differential Equation (DE), Linear Algebra (LA), Complex Variables (CV), Discrete Mathematics (DM)

Program Outcome Policy:

Course VS Course Outcomes

(H= Highly Related, S = Supportive, N = None)

Course	a	b	c	d	e	f	g	h	i	j	k
Computer and Microprocessor Control Systems	H	S	H	S	H	N	N	N	N	N	H

The electrical and electronics engineering program outcomes are:

a. Ability to apply knowledge of mathematics, science and engineering.

b. Ability to design and conduct experiments.

c. Ability to design a system, component or process to meet desired needs.

d. Ability to function on multidisciplinary teams.

e. Ability to identify, formulate and solve engineering problems.

f. Understanding of professional and ethical responsibility.

g. Ability to communicate effectively.

h. Broad education necessary to understand the impact of engineering solutions in global and societal context.

i. Recognition of the need for and an ability to engage in life-long learning.

j. Knowledge of contemporary issues.

k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Course Assessment Policy:

- There will be approximately 6 homework assignments. Homework is due one week after assignment unless otherwise noted, no late homework is accepted. Zero mark will be given when homework is copied. Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework.
- Three quizzes will be held during the semester.
- One mid-term exam and one final exam will be given with 2 hours and 3 hours respectively.