

**ECE 6720 FUZZY CONTROL SYSTEMS**  
**Fall 2011**

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**Office Hours:** M 4:30-5:20pm, or by appointment  
**Class:** T 3:30-6:20pm, D-206, CEAS

**Texts**

**Required:** George J. Klir, Bo Yuan, *Fuzzy Sets and Fuzzy Logic: Theory and Applications*, Prentice-Hall, Inc., 1995  
Instructor's Lecture Notes, available through the IEEE Student Branch  
Selected papers

**Recommended:** Ronald R. Yager, Dimitar P. Filev, *Essentials of Fuzzy Modeling and Control*, John Wiley and Sons, Inc., 1994  
John Wakerly, *Digital Design Principles and Practices, Third Edition*, Prentice Hall, 2000  
current Xilinx WebPack and ModelSim software

The recommended texts will be made available in the Reserve Section of Waldo Library. The Xilinx software is available for free download through the Xilinx Web site.

**Prerequisites:** ECE 5710, or ECE 5570, or equivalent

**Prerequisites by topic:** Linear controls  
Digital systems design

**Course Description**

Among the various paradigmatic changes in science and mathematics, one such change concerns the concept of uncertainty. The driving force behind this paradigm shift is the realization that traditional two-valued logical decision systems, crisp set theory and crisp probability theory are inadequate for dealing with imprecision, uncertainty and complexity of the real world. It is this realization that motivates the evolution of fuzzy set theory and fuzzy logic. One of the most successful fields of application of fuzzy set theory has been in control systems. This course is designed to address the theoretical aspects of fuzzy set theory and fuzzy logic, fuzzy control, the implementation issues of fuzzy controllers, and application of fuzzy logic in supervisory control.

**Main topics to be covered in this course include:**

1. Fuzzy set theory
2. Fuzzy logic and approximate reasoning
3. Hardware accelerators for fuzzy logic
4. Fuzzy control
5. Fuzzy controller applications
6. Supervisory control using fuzzy automata

Students will be given three project assignments: the first one will be the presentation of a seminal paper in fuzzy set theory, the second one will be a fuzzy logic circuit design project using VHDL and programmable logic devices. The third one will be the software implementation and verification of a fuzzy automaton using Matlab for an intelligent decision support system. The design projects will be demonstrated in the Microcomputer Lab (Room B-214) and in class, respectively.

### **Course Procedure**

There will be a **Final Exam** to be taken, **one presentation and two design projects** to be completed, and **homework** to be done. **Homework is individual work!** The presentation and the homework assignments are not accepted after they are due. The projects will be accepted up to five days after due date (not after the last day of classes, though) but will be penalized 10% for each day that is tardy! Failure to attend the Final Exam or work on the design projects will result in a grade X for the course. A make-up exam will only be given under extreme circumstances, and in any case, students should ask the course instructor prior to any scheduled assessment.

### **Grading Policy**

Grades will be determined on the basis of performance on the final exam, the completeness and quality of the presentations and the project, and homework, according to the following weights:

<b>Homework:</b>	<b>10%</b>
<b>Presentation:</b>	<b>10%</b>
<b>Project #1:</b>	<b>30%</b>
<b>Project #2:</b>	<b>20%</b>
<b>Final Exam:</b>	<b>30%</b>

The breakdown for letter grades will be as follows: **100-85 A, 84-78 BA, 77-71 B, 70-64 CB, 63-57 C, 55-50 D, 49 and below E**, missed project or final exam E, or X as appropriate. In borderline cases, the final exam may be given a higher weight, at the instructor's discretion.

### **Schedule for the presentation and the projects:**

**The presentation is due 3:30pm, on Tuesday, October 11, 2011**  
**Project #1 is due 3:30pm, on Tuesday, November 22, 2011**

**Project #2 is due 3:30pm, on Tuesday, December 6, 2011**

Permission to miss any due date may be granted by the instructor under extreme circumstances. If permission is desired, a request must be made before the due date and should include either a signed doctor's explanation or a written explanation signed by an appropriate WMU officer.

**The Final Exam will be given 12:30 – 2:30pm, on Thursday, December 15, 2011, in Room D-206, CEAS.**

**Codes and Policies**

The ECE 6720 Web Home Page will be used as official communications media for the class. Students must check the Home Page on a daily basis.

The WMU College of Engineering and Applied Sciences Honesty Code will apply in this course.

Homework is individual work! Students may discuss with their classmates the basic approaches to arrive at the solutions in principle. However, they are not allowed to share calculations, program files, and the like. Similarly, there must not be leaks of concrete design information among project teams.

You are responsible for making yourself aware of and understanding the policies and procedures in the Graduate Catalog that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. The policies can be found at <http://catalog.wmich.edu> under Academic Policies, Student Rights and Responsibilities. If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

Furthermore, students are encouraged to visit to <http://osc.wmich.edu> and [www.wmich.edu/registrar](http://www.wmich.edu/registrar) to access the Code of Honor and general academic policies on such issues as diversity, religious observance, student disabilities and other topics.