Syllabus

Course Number: ECE 6690

Title: Introduction to Fuzzy Systems

Credits: 4 (Lecture)

WSU Catalog Description: Prereq: IE 3220 or CHE 3040, or consent of instructor.

Instructor: Hao Ying, Professor of Electrical and Computer Engineering

Office Hours: Mondays and Wednesdays, 9:30PM - 10:30AM, or by appointment

Office Location: 3144 Engineering Building

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Course Meeting Time: Mondays and Wednesdays, 10:40AM - 12:30PM, 01/09/2005 - 04/26/2005 (final exam)

Course Meeting Location: 0120 Mano

Goals: To develop the ability to design and analyze electrical systems involving fuzzy logic techniques.

Learning Objectives: At the end of this course, students will be able to:

1. Describe and compute vague concepts using fuzzy sets and fuzzy logic
2. Construct fuzzy rules and perform fuzzy reasoning on them
3. Design some common fuzzy systems and fuzzy controllers.
4. Illustrate the organization, design and operation of some common fuzzy systems

Textbook:

Prerequisites by Topic: none

Corequisites by Topic: none

Topics:

1. Fuzzy Sets
2. Fuzzy Relations, Fuzzy Graphs, and Fuzzy Arithmetic
3. Fuzzy If-Then Rules
4. Fuzzy Implications and Approximate Reasoning
5. Fuzzy Logic
6. Fuzzy Logic and Artificial Intelligence
7. Fuzzy Logic in Database and Information Systems
8. Fuzzy Logic in Pattern Recognition
9. Fuzzy Logic Control
10. Fuzzy Logic Control Applications
11. Fuzzy Discrete Event Systems

Course Structure: We will cover major portion of Chapters 1 to 7, 11, 12, and 13 of the textbook by Yen and Langari. There will be homework assignments and computer projects for some of the chapters. Homework assignments should be completed independently, and copying will not be acceptable. Deadlines for submitting homework assignments will be specified on each assignment and should be strictly observed. Homework solutions will be emailed to the student after the homework is returned to him/her.

All exams will be closed-book exams (only a two-page handwriting note will be allowed).

We will also spend some time to study a medical application of fuzzy logic control as well as fuzzy discrete event system and its application to AIDS treatment (an ongoing novel research project of Dr. Ying).

Homework Format: A cover page: It should include: course name, chapter number, problem numbers, student name and student ID. For projects, computer code should be turned in along with other project material.

Computer Resources: The course can be best learned using computer simulation on MATLAB (e.g., Fuzzy Logic Toolbox), which is available at the Engineering PC Lab on the second floor of the Engineering Building.

Laboratory Resources: MATLAB and its toolboxes

Grading Weights:
Homework/Projects: 20 %
Midterm Exam: 40 %
Final Exam: 40 %

Grading Scale:
A = 90-100, A- = 88-89, B+ = 85-87, B = 80-84, B- = 78-79, C+ = 75-77, C = 70-74, C- = 68-69, D+ = 65-67, D = 63-64, D- = 60-62, E or F = 59 or below

Attendance: A student is expected to attend all lectures. An Attendance Sheet will be required to be signed by every student in every lecture. Active class participation is expected of all students.

It is the student's responsibility to learn the course material. When classes are missed, for whatever reason, it is the obligation of the student to obtain copies of the class materials and the student is responsible for all materials covered in the lectures. An excused absence does not excuse the student from completing assigned work, including exams.

Schedule: Midterm Exam will be given around February 22 and Final Exam on April 26. All students must take the exams on the scheduled dates. No make-up examination will be allowed. Special and legitimate circumstances will be considered but the instructor should be notified as early as possible.

Outcome Coverage:
(a) An ability to apply math, science and engineering knowledge. Fuzzy logic techniques are relatively new
engineering methodologies. The learning will require direct application of mathematical, scientific, and engineering knowledge. The learning requires performing computations involving set operations, calculus, matrix theory, control theory, among other techniques.

(b) *An ability to design and conduct experiments, as well as to analyze and interpret data.* Students will carry out system design and analysis as well as interpretation of the resulting data using MATLAB and its Fuzzy Logic Toolbox.

(c) *An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.* Fuzzy Logic provides a cost-effective way to more realistically deal with the constraints. This point will be illustrated and discussed throughout this course. This outcome is a minor component of the course, though.

(e) *Identify, formulate and solve engineering problems.* The students will learn how to identify, formulate, and solve various engineering problems in the areas of knowledge representation, uncertainty handling, artificial intelligence, databases, pattern recognition, and control.

(h) *The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.* Students taking the course will realize the broad applicability of fuzzy logic to electrical and systems engineering and its impact and benefits to solving real world problems with positive economic and societal consequences.

**Cheating Policy and Penalty for Cheating:** It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge.

Cheating will not be tolerated. Cheating includes (but is not limited to) any communication (written or oral, active or passive) during examinations and sharing of work, such as using the same models or computer programs or copying work. All homework and projects must be an individual effort unless specifically noted. **STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE (i.e., F) FOR THE COURSE.** Students who witness cheating should report the incident to the instructor as soon as possible (your identity will be strictly protected).

**Notes:**
(1) Deferred/incomplete grades will only be granted to students with medical or other unforeseen excuse. The WSU policy is
   · if the student is not currently failing the class, and
   · if there is not a substantial quantity of work yet to be completed, and
   · if there is no extra work required of the instructor beyond the normal duties of grading the paper/exam, and
   · if their is no need for the student to attend the class in subsequent terms.

(2) Please keep in mind the last day to drop a class with a tuition refund. College of Engineering does not allow withdrawal from courses after the fifth week of classes except under exceptional circumstances. Failing of a class is not an acceptable excuse for withdrawal after the 5th week.

**Prepared By:** Hao Ying, Professor of Electrical and Computer Engineering

**Last Revised:** January 6, 2006