

<b>Subject</b>	Fuzzy Logic	<b>Course Code</b>	CT430	<b>Theoretical</b>	3hrs / wk
<b>Semester</b>	7	<b>Prerequisite</b>	CT227	<b>Practical</b>	3hrs / wk

### Course Discription:

This course introduces the student to intelligent control theory. The course material is divided in two main parts: Fuzzy Logic and Artificial Neural Networks techniques. Emphasize is provided for intelligent control applications of control systems.

	<b>Specific Learning Outcomes</b>	<b>Note</b>
<b>Week 1</b>	Introduction: History, Background and Applications	Reference 2 Chapter 1
<b>Week 2</b>	Review of Classical Control: Math Models, Controller Design, PID Control	Reference 3
<b>Week 3</b>	Fuzzy Sets Basic Definition: Classical Set Theory, Fuzzy Sets, Fuzzy Operations, Properties and Relations	Chapter 8
<b>Week 4</b>	Fuzzy logic: Predicate Logic, Fuzzy Logic, Approximate Reasoning	Chapter 9
<b>Week 5</b>	Fuzzy Control: Fuzzification, Fuzzy Rules	Chapter 10
<b>Week 6</b>	Fuzzy Control: Inference Engine (Mamdani and Larsen), Defuzzification	Chapter 10
<b>Week 7</b>	Fuzzy Control: Fuzzy Control Design, MATLAB	Chapter 10

	Simulation	
<b>Week 8</b>	<b>Specific Learning Outcomes</b>	<b>Note</b>
	Fuzzy Control Application: Autonomous Robots, HVAC	Chapter 11, Chapter13
<b>Week 9</b>	<b>Specific Learning Outcomes</b>	<b>Note</b>
	Fundamentals of Neural Networks: Definitions/Elements, Single Layer Perceptron	Chapter 2
<b>Week 10</b>	<b>Specific Learning Outcomes</b>	<b>Note</b>
	Fundamentals of Neural Networks: Perceptron Architecture and Algorithm	Chapter 2
<b>Week 11</b>	<b>Specific Learning Outcomes</b>	<b>Note</b>
	Neural Network Architecture: Different Architectures, Backpropagation Algorithm	Chapter 3
<b>Week 12</b>	<b>Specific Learning Outcomes</b>	<b>Note</b>
	Neural Network Architecture: Radial Basis Functions	Chapter 3
<b>Week 13</b>	<b>Specific Learning Outcomes</b>	<b>Lab</b>
	Neural Network Architecture: Self-Organizing Networks, Hopfield Networks	Chapter 3
<b>Week 14</b>	<b>Specific Learning Outcomes</b>	<b>Lab</b>
	Neural Control: Design and Examples, MATLAB Simulation	Reference 4

### Course Assessment:

Course Work	Mid-term Tests	Final Examination	Final Exam Practical
10	30	40	20

**NOTE:** Course Work may include Assignments, Lab reports, Projects and Practical Activities.

**Textbooks:**

2. A First Course in Fuzzy and Neural Control by Nguyen, Prasad, Walker, and Walker. CRC 2003.
3. Artificial Intelligence by Negnevisky. Addison-Wesley.
4. Automatic Control Systems by Colnaraghi and Kuo. 9th edition. Wiley Publisher. 2010.
5. “An Introduction to the use of Neural Networks in Control Systems” white paper by Martin Hagan, Demuth, and De Jesus.
6. MATLAB Fuzzy Logic Toolbox: user’s guide.
7. MATLAB Neural Network Toolbox: user’s guide.