

<b>Course title</b>	<b>Fuzzy Sets, Logic, and Applications</b>																
<b>Course number</b>	COMP 605																
<b>Credit hours (lecture and lab)</b>	3 (3 + 0)																
<b>ECTS (weekly contact and self-study load)</b>	6 (3 + 3)																
<b>Prerequisites/co-requisites by course number and name</b>	None																
<b>Prerequisites by topic (other than the formal prerequisites above)</b>	None																
<b>Level and type (compulsory, elective)</b>	Masters' elective course																
<b>Year of study and semester</b>	Any																
<b>Catalogue description</b>	Fuzzy set and related concepts. Logical connectives. Mapping of fuzzy sets. Fuzzy relations and fuzzy set ordering. Fuzzy logic inference. Applications: fuzzy control, signal processing, pattern recognition, decision making, expert systems, fuzzy Logic in Databases, Information Retrieval with Fuzzy Logic, Fuzzy Intelligent Agents, Automotive Applications. Knowledge Engineering and Data Mining.																
<b>Objectives</b>	This course introduces students to the basic concepts of modeling in systems using fuzzy sets. The concepts of fuzzy logic are introduced and their role in applications such as fuzzy control, signal processing, pattern recognition, etc. The students are introduced to the of fuzzy logic toolboxes and libraries in tools such as MATLAB and Python.																
<b>Intended learning outcomes</b>	Upon successful completion of this course, students will be able to: <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="text-align: center;">No</th> <th style="text-align: center;">Intended learning Outcome (ILO)</th> <th style="text-align: center;">Program learning outcome (PLO)*</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Demonstrate understanding of basic knowledge of fuzzy sets, operations, and their properties.</td> <td style="text-align: center;">1, 3</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Demonstrate understanding of the fundamental concepts of Fuzzy logic.</td> <td style="text-align: center;">1, 3</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Apply the concepts of Fuzzy sets and logic various applications.</td> <td style="text-align: center;">3, 4</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Use Fuzzy logic toolboxes and libraries in under MATLAB and Python.</td> <td style="text-align: center;">2, 4</td> </tr> </tbody> </table> <p style="margin-top: 10px;">(*) The PLOs are listed in the appendix</p>		No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*	1	Demonstrate understanding of basic knowledge of fuzzy sets, operations, and their properties.	1, 3	2	Demonstrate understanding of the fundamental concepts of Fuzzy logic.	1, 3	3	Apply the concepts of Fuzzy sets and logic various applications.	3, 4	4	Use Fuzzy logic toolboxes and libraries in under MATLAB and Python.	2, 4
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<b>Teaching and learning methods</b>	Development of ILOs is promoted through the following teaching and learning methods: <ul style="list-style-type: none"> <li>• The Digital Systems Lab. is open for the students to practice the practical aspects and solve the programming homework assignments.</li> <li>• The student attends the class presentations and participates in the discussions.</li> <li>• The student joins the related online team/group and participates in its discussions.</li> <li>• The student studies the reference material, including books and videos.</li> <li>• The student solves the programming assignments in fuzzy logic.</li> <li>• The student carries out a term project for solving a problem using fuzzy logic techniques.</li> <li>• The student develops a professional report for the term report.</li> <li>• The student presents the term project in class.</li> </ul>																																																																			
<b>Learning material type</b>	Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.																																																																			
<b>Resources and references</b>	A- Required book(s), assigned reading and audio-visuals: <ol style="list-style-type: none"> <li>1. Ross, Timothy J. "Fuzzy logic with engineering applications. Southern Gate." ed: Chichester, West Sussex, United Kingdom: Wiley (2017).</li> </ol> B- Recommended book(s), material and media: <ol style="list-style-type: none"> <li>2. Klir, George J., Ute St. Clair, and Bo Yuan. Fuzzy set theory: foundations and applications. Prentice-Hall, Inc., 1997.</li> </ol>																																																																			
<b>Topic outline and schedule</b>	<table border="1"> <thead> <tr> <th>Week</th> <th>Topic</th> <th>ILO</th> <th>Resources</th> </tr> </thead> <tbody> <tr><td>1</td><td>Introduction to Fuzzy Logic</td><td>2</td><td>1, 2</td></tr> <tr><td>2</td><td>Fuzzy Set Theory</td><td>1</td><td>1, 2</td></tr> <tr><td>3</td><td>Fuzzy Arithmetic</td><td>2, 4</td><td>1, 2</td></tr> <tr><td>4</td><td>Fuzzy Relations</td><td>1, 2</td><td>1, 2</td></tr> <tr><td>5</td><td>Possibility Theory</td><td>2</td><td>1, 2</td></tr> <tr><td>6</td><td>Fuzzy Inference</td><td>1</td><td>1, 2</td></tr> <tr><td>7</td><td>Approximate Reasoning</td><td>1</td><td>1, 2</td></tr> <tr><td>8</td><td>Fuzzy Hierarchical Control</td><td>3, 4</td><td>1</td></tr> <tr><td>9</td><td>Pattern Recognition</td><td>3, 4</td><td>1</td></tr> <tr><td>10</td><td>Fuzzy Logic in Databases</td><td>3, 4</td><td>1</td></tr> <tr><td>11</td><td>Information Retrieval with Fuzzy Logic</td><td>3, 4</td><td>1</td></tr> <tr><td>12</td><td>Fuzzy Intelligent Agents</td><td>3, 4</td><td>1</td></tr> <tr><td>13</td><td>Engineering Applications</td><td>3, 4</td><td>1</td></tr> <tr><td>14</td><td>Computer Network Applications</td><td>3, 4</td><td>1</td></tr> <tr><td>15</td><td>Term Project Presentations</td><td>1-4</td><td>1, 2</td></tr> </tbody> </table>	Week	Topic	ILO	Resources	1	Introduction to Fuzzy Logic	2	1, 2	2	Fuzzy Set Theory	1	1, 2	3	Fuzzy Arithmetic	2, 4	1, 2	4	Fuzzy Relations	1, 2	1, 2	5	Possibility Theory	2	1, 2	6	Fuzzy Inference	1	1, 2	7	Approximate Reasoning	1	1, 2	8	Fuzzy Hierarchical Control	3, 4	1	9	Pattern Recognition	3, 4	1	10	Fuzzy Logic in Databases	3, 4	1	11	Information Retrieval with Fuzzy Logic	3, 4	1	12	Fuzzy Intelligent Agents	3, 4	1	13	Engineering Applications	3, 4	1	14	Computer Network Applications	3, 4	1	15	Term Project Presentations	1-4	1, 2			
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<b>Evaluation tools</b>	Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:			
	<b>Assessment tool</b>	<b>Mark</b>	<b>Topic(s)</b>	<b>Time</b>
	Homework assignments	10%	Theoretical aspects	W1-W7
	Midterm exam	30%	Applications	W8-W14
	Term project report and presentation	20%	Practical and presentation aspects	W8-W15
	Final exam	40%	All material	W16
	<b>Total</b>	<b>100%</b>		
<b>Student requirements</b>	The student should have a computer and internet connection.			
<b>Course policies</b>	<p>A- Attendance policies:</p> <ul style="list-style-type: none"> <li>Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard.</li> </ul> <p>B- Absences from exams and not submitting assignments on time:</p> <ul style="list-style-type: none"> <li>A makeup exam can be arranged for students with acceptable absence causes.</li> <li>Assignments submitted late, but before announcing or discussing the solution can be accepted with 25% penalty.</li> <li>The project report must be handed in in time.</li> </ul> <p>C- Health and safety procedures:</p> <ul style="list-style-type: none"> <li>All health and safety procedures of the university and the school should be followed.</li> </ul> <p>D- Honesty policy regarding cheating, plagiarism, misbehavior:</p> <ul style="list-style-type: none"> <li>Open-book exams</li> <li>All submitted work must be of the submitting student.</li> <li>Other text or code must be properly quoted with clear source specification.</li> <li>Cheating will not be tolerated.</li> </ul> <p>E- Available university services that support achievement in the course:</p> <ul style="list-style-type: none"> <li>Moodle course page</li> <li>AI Lab for practicing the practical aspects and solving the programming assignments.</li> <li>Program announcements Facebook group</li> </ul>			
<b>Additional information</b>	None			