1. Title of subject	Fuzzy Logic
2. Subject code	TFL 7441
3. Status of subject	Elective
4. Credit Hour	3 28 Hours of Lecture 28 Hours of Laboratory LAN's Credit Hours Equivalence: 3.00
5. Semester	Trimester 2 (Delta level)
6. Pre-Requisite	TAI 7361 Artificial Intelligence I
7. Methods of teaching	28 Hours of Lecture 28 Hours of Laboratory
8. Assessment	Coursework: 40 % - Test 20 % - Assignment 20 % Final Exam: 60 % **Total 100%**
9. Teaching staff (Proposed)	Mr. Tan Shin Chiang
10. Objective of subject	To introduce the topics of fuzzy sets, fuzzy logic to engineers, scientists, and others who wish to explore the application of fuzzy logic techniques. To familiarize the students the emerging concepts of Fuzzy Logic and its applications in the field of AI and Control Systems.
11. Synopsis of subject	The major area of studies include Fuzzy Sets and Crisp Sets; Operations on Fuzzy Sets; Fuzzy Arithmetic; Fuzzy Relations; Fuzzy Relation Equations; Fuzzy Quantities; Possibility Theory; Fuzzy Logic; Logical Aspects of Fuzzy Sets; Uncertainty-Based Information; Constructing Fuzzy Sets and Operations on Fuzzy Sets; Approximate Reasoning; Fuzzy Systems; Fuzzy Decision Making; Fuzzy Logic Applications. The course will expose the students to the overall understanding and knowledge in Fuzzy Logic. Bidang pengajian utama merangkumi set kabur dan set Krisp, pengendalian untuk set kabur, aritmetik kabur, hubungan kabur, persamaan hubungan kabur, kuantiti kabur, teori posibiliti, Logik kabur, nisbah logik untuk set kabur, infomasi tak kepastikan, binaan set kabur, pengendalian untuk set kabur, pentaakulan Aprosimet, sistem kabur, buat keputusan kepada kabus dan penggunaan logik kabur. Melalui kursus ini pelajar akan didedahkan kepada pemahaman dan pengetahuan dalam topik Logik Kabur.
12. Learning Outcomes	By the end of the subject, the students should be able to: • Demonstrate the concepts of Fuzzy Set, Fuzzy Logic, Possibility Theory, Probability Theory, Uncertainty,

	Approximate Reasoning, Fuzzy Systems and Fuzzy Decision Making. • Solve problems with fuzzy systems.	
	Programmes Outcomes	**Degree of Contribution (%)**
	• Ability to apply soft skills in work and career related activities	5
	• Good understanding of fundamental concepts	20
	• Acquisition and mastery of knowledge in specialized area	30
	• Acquisition of analytical capabilities and problem solving skills	30
	• Adaptability and passion for learning	5
	• Cultivation of innovative mind and development of entrepreneurial skills	5
	• Understanding of the responsibility with moral and professional ethics	5
13. Details of subject	**Topics Covered**	**Hours**
	1. An Overview of Fuzzy Logic An Overview of Crisp Sets; The Concept of Fuzziness; Basic Types of Fuzzy Sets; Fuzzy Sets: Basic Concepts. Characteristics and Significance of the Paradigm Shift.	1
	2. Fuzzy Sets versus Crisp Sets Properties of Cuts. Representations of Fuzzy Sets. Extension Principle for Fuzzy Sets.	2
	3. Operations on Fuzzy Sets Types of Operations. Fuzzy Complements. Fuzzy Intersections: t-Norms. Fuzzy Unions: t-Conorms. Combinations of Operations. Aggregation Operations.	2
	4. Fuzzy Arithmetic Fuzzy Numbers. Linguistic Variables. Arithmetic Operations on Intervals. Arithmetic Operations on Fuzzy Numbers. Lattice of Fuzzy Numbers. Fuzzy Equations.	2
	5. Fuzzy Relations	

	Crisp versus Fuzzy Relations. Projections and Cylindric Extensions. Binary Fuzzy Relations. Binary Relations on a Single Set. Fuzzy Equivalence Relations and Partitions. Fuzzy Compatibility Relations. Fuzzy Ordering Relations. Fuzzy Morphisms. Alpha-Cuts; Images of Alpha-Level Sets; Sup-i Compositions of Fuzzy Relations. Inf-Compositions of Fuzzy Relations; Equivalence Relations and Partitions.	2
	6. Fuzzy Relation Equations General Discussion. Problem Partitioning. Solution Method. Fuzzy Relation Equations Based on Sup-i Compositions. Fuzzy Relation Equations Based on Inf-Compositions. Approximate Solutions. The Use of Neural Networks.	2
	7. Fuzzy Quantities Fuzzy Numbers; Fuzzy Intervals.	2
	8. Possibility Theory Fuzzy Measures. Evidence Theory. Possibility Theory. Fuzzy Sets and Possibility Theory. Possibility Theory versus Probability Theory.	2
	9. Fuzzy Logic Classical Logic: An Overview. Multivalued Logics. Fuzzy Propositions. Fuzzy Quantifiers. Linguistic Hedges. Inference from Conditional Fuzzy Propositions. Inference from Conditional and Qualified Propositions. Inference from Quantified Propositions.	2
	10. Logical Aspects of Fuzzy Sets Three-Valued Logic; Guzzy and Lukasiewicz Logics; Interval Valued Fuzzy Logic; Probabilistic Logic.	2
	11. Uncertainty-Based Information Information and Uncertainty. Nonspecificity of Crisp Sets. Nonspecificity of Fuzzy Sets. Fuzziness of Fuzzy Sets. Uncertainty in Evidence Theory. Summary of Uncertainty Measures. Principles of Uncertainty.	2
	12. Constructing Fuzzy Sets and Operations on Fuzzy Sets and Approximate Reasoning Methods of Construction: An Overview. Direct Methods with One Expert. Direct Methods with Multiple Experts. Indirect Methods with One Expert. Indirect Methods with Multiple Experts. Constructions from Sample Data. Fuzzy Expert Systems: An Overview. Fuzzy Implications. Selection of Fuzzy Implications. Multi-	3

	conditional Approximate Reasoning. The Role of Fuzzy Relation Equations. Interval-Valued Approximate Reasoning.	
	13. Fuzzy Systems Fuzzy Controllers: An Overview. Fuzzy Controllers: An Example. Fuzzy Systems and Neural Networks. Fuzzy Neural Networks. Fuzzy Automata. Fuzzy Dynamic Systems.	2
	14. Fuzzy Decision Making and Fuzzy Logic Applications Individual Decision Making. Multiperson Decision Making. Multicriteria Decision Making. Multistage Decision Making. Fuzzy Ranking Methods. Fuzzy Linear Programming. Fuzzy Pattern Recognition; Fuzzy Databases and Information Retrieval Systems; Engineering Applications.	2
Laboratory	Fuzzy Sets and Crisp Sets Operations on Fuzzy Sets Fuzzy Arithmetic Fuzzy Relations Fuzzy Quantities Possibility Theory Fuzzy Logic Logical Aspects of Fuzzy Sets Uncertainty-Based Information Constructing Fuzzy Sets and Operations on Fuzzy Sets Approximate Reasoning Fuzzy Systems Fuzzy Decision Making	
	Total Contact Hours	**28**
14. Text	**Text book**	George J. Klir, Bo Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, 1995.