Course Description Form

1. Course Name:
Fuzzy Theory

2. Course Code:
MATH513

3. Semester / Year:
First / 2023-2024

4. Description Preparation Date:
23-3-2024

5. Available Attendance Forms:
Attendance lectures in the classroom

6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours / 3 units

7. Course administrator's name (mention all, if more than one name)
Name: Asst. Prof. Dr. Fadhel Subhi Fadhel Email: fadhel.subhi@nahrainuniv.edu.iq

8. Course Objectives	
Course Objectives	• Studying fuzzy logic and its connection with classical mathematical logic in set theory. • Reviewing and studying the basic algebraic and mathematical properties, as well as, fundamental operations on fuzzy sets. • Formulating some real-life problems using fuzzy logic and indicating the appropriateness of fuzzy logic in these studies. • Introducing the subject of α-level sets, as well as its basic properties and some fundamental related concepts. • Studying different types of fuzzy numbers using interval arithmetic. • Studying some mathematical topics using fuzzy logic, such as evaluating fuzzy derivatives and integrals, solution of fuzzy differential equations.

9. Teaching and Learning Strategies	
Strategy	The teaching and learning strategy is considered a set of tools and practices carried out by both the teacher and the student in order to comprehend the academic material or course, which is the theory of fuzzy sets, in the best possible way. This depends on two basic factors: good transmission by the subject teacher, which is supported by teaching strategies, and good reception by the student, which is supported by

learning strategies. Educational strategies include a set of organized plans and methods followed by the subject teacher in order to guide students towards achieving learning goals, including the cognitive goals of fuzzy logic, the skill goals in formulating life problems in a mathematical manner by representing them with a mathematical model, and the emotional and value goals through the sensory perception of the nature of the problem and how to deal with it. With it, this is done through specific teaching and learning methods in order for the student to acquire transferable general and qualifying skills.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Introducing fuzzy logic and its history	Basic definitions illustrative examples	Attendance interactive lectures	Ask questi and g assignments
2	3	Studying the basic set theoretic operations in fuzzy logic	Fuzzy set theoretical operations	Attendance interactive lectures	Ask questions and give assignments
3	3	Study the basic algebraic operations with examples	Basic algebraic operations	Attendance interactive lectures	Ask questions and give assignments
4	3	Generalization of non-fuzzy concepts to fuzzy logic	Expansion principle	Attendance interactive lectures	Ask questions and give assignments
5	3	Introducing the α-level sets and its connection with crisp sets	α-Level sets	Attendance interactive lectures	Ask questions and give some homeworks
6	3	Studying the membership functions and how to find some of them analytically	The membership functions	Attendance interactive lectures	Ask questions and give assignments
7	3	Introduce some types of fuzzy numbers and their relationship to fuzzy sets	Fuzzy numbers	Attendance interactive lectures	Ask questions and give assignments

					Ask questions and give assignments
8	3	Formulating fuzzy numbers as closed intervals using α-level sets and studying interval arithmetic	Interval fuzzy numbers	Attendance interactive lectures	Ask questions and give assignments
9	3	Studying different types of fuzzy functions	Fuzzy function	Attendance interactive lectures	Ask questions and give assignments
10	3	How to use the extension principle to find fuzzy derivatives and integrals	Fuzzy derivatives and integrals	Attendance interactive lectures	Ask questions, give assignments, and make a 1st attendance mid exam
11	3	Introducing the fuzzifying function and find its derivatives (left-right)	Fuzzyfying function	Attendance interactive lectures	Ask questions and give assignments
12	3	Introducing fuzzy differential equations	Fuzzy differential equations	Attendance interactive lectures	Ask questions and give assignments
13	3	Solving fuzzy differential equations analytically using complex numbers representation	Analytic solution of linear system of fuzzy ODEs	Attendance interactive lectures	Ask questions and give assignments
14	3	Solution of fuzzy ODEs using interval arithmetic	Analytical Solution of Linear Interval Fuzzy ODEs	Attendance interactive lectures	Ask questions, give assignments, and make a 2nd attendance mid exam
15	3	Study the numerical solutions of fuzzy differential equations	Fuzzy differential equations	Attendance interactive lectures	Ask questions and give assignments

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports ... etc.

20% monthly written exams

10% daily and oral exams, homework's, and class activities

70% written final exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fuzzy Set Theory and Its Applications, Third Edition, By: H.-J. Zimmermann, 1996.Fuzzy Mathematical Techniques with Applications, By: Kamdel A., 1985.
Main references (sources)	Fuzzy Set Theory, Foundations and Applications, by Klir G. J.
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	