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|  **ECTS Course Description Form** |
| **PART I ( Senate Approval)** |
| **Offering School**  | **College of Engineering** |
| **Offering Department** | **Industrial Engineering** |
| **Program(s) Offered to** | **Industrial Engineering** |  |
| **Other Engineering Departments** |  |
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| **Course Code**  | **IE-428** |
| **Course Name** | **Introduction to Fuzzy Logic** |
| **Language of Instruction** | **English** |
| **Type of Course** | **Elective** |
| **Level of Course** | **Undergraduate** |
| **Hours per Week** | **Lecture: 3** | **Laboratory:** | **Recitation:**  | **Practical:**  | **Studio:** | **Other:** |
| **ECTS Credit** | **6** |
| **Grading Mode** | **Letter Grade** |
| **Pre-requisites** | **-** |
| **Co-requisites** | **-** |
| **Registration Restriction** | *-* |
| **Educational Objective** | **This course is designed to introduce the student to the theory and applications of fuzzy logic, fuzzy logic control, and algorithms where fuzzy logic and fuzzy numbers are used. It includes the fundamentals of fuzzy sets, fuzzy rules and relations, decision-making systems, fuzzy control systems, optimization using fuzzy sets and numbers, Algorithms and methods for industrial engineering applications, ANFIS are discussed.** |
| **Course Description** | **The fundamentals of fuzzy sets, fuzzy rules, decision-making systems, fuzzy control systems, optimization using fuzzy sets and numbers, and advanced topics. Algorithms and methods for industrial engineering applications, Neuro-fuzzy systems (ANFIS).** |
| **Learning Outcomes**  | **LO1** |

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| 1 | Understand the concept of fuzzy sets and numbers |
| 2 | Understand the differences between randomness and vagueness |
| 3 | Use the concepts of fuzzy sets and numbers in engineering applications where there isambiguity and vagueness |
| 4 | Use optimization software involving fuzzy sets and numbers to find viable solutions torealistic problems and interpret the solutions |

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| **LO2** |
| **LO3** |
| **LO4** |
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| **PART II ( Faculty Board Approval)** |
| **Basic Outcomes (University-wide)** | **No.** | **Program Outcomes** | **LO1** | **LO2** | **LO3** | **LO4** |
| **PO1** | **Ability** to communicate effectively and write and present a report in Turkish and English.  | 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸  |
| **PO2** | **Ability** to work individually, and in intra-disciplinary and multi-disciplinary teams. |
| **PO3** | **Recognition** of the need for life-long learning and **ability** to access information, follow developments in science and technology, and continually reinvent oneself. |
| **PO4** | **Knowledge** of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. |
| **PO5** | **Awareness** of sectors and **ability** to prepare a business plan. |
| **PO6** | **Understanding** of professional and ethical responsibility and **demonstrating** ethical behavior. |
| **Faculty Specific Outcomes** | **PO7** | Ability to develop, select and use modern techniques and tools necessary for engineering applications and ability to use information technologies effectively. |
| **PO8** | Recognition of the effects of engineering applications on health, environment and safety in the universal and societal dimensions and the problems of the time and awareness of the legal consequences of engineering solutions. |
| **PO9** | Ability to identify, define, formulate and solve complex engineering problems; and electing and applying appropriate analysis and modeling methods for this purpose. |
| **Discipline Specific Outcomes (program)** | **PO10** | Sufficient knowledge in fuzzy logic, science and Industrial engineering; and the ability to apply theoretical and practical knowledge in these areas to model and solve engineering problems. |
| **PO11** | Ability to design a fuzzy inference system, process, device or product to meet specific requirements under realistic constraints and conditions of economic, environmental, sustainability, manufacturability, ethics, health, safety, social and political issues; and the ability to apply modern design methods for this purpose. |
| **PO12** | Ability to design systems, conduct experiments, collect data, analyze and interpret results for the examination of Industrial engineering problems. |
| **Specialization Specific Outcomes** | **PO N….** | Ability to simulate a given real life problem and analyze the real problem using the simulation and recommend solutions to the real life problem |
| **PART III ( Department Board Approval)** |
| **Course Subjects, Contribution of Course Subjects to Learning Outcomes, and Methods for Assessing Learning of Course Subjects** | **Subjects** | **Week** |  | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
| **S1** | *1* | Introduction to Fuzzy Logic | *A1,A2,A3* |
| **S2** | *2* | Basic concepts of fuzzy sets and systems | *A1,A2,A3* |
| **S3** | *3* | Fuzzy Arithmetic and Operations on Fuzzy Sets | *A1,A2,A3* |
| **S4** | *4* | Fuzzy Relations | *A1,A2,A3* |
| **S5** | *5* | The Extension Principle of Zadeh | *A1,A2,A3* |
| **S6** | *6* | Fuzzy Numbers | *A1,A2,A3* |
| **S7** | *7* | Fuzzy Rule-Based System | *A1,A2,A3* |
| **S8** | *8* | MIDTERM |  |  |  |  |  |  |
| **S9** | *9* | Fuzzy Logic Control | *A1,A2,A3* |
| **S10** | *10* | Fuzzy Decision Making | *A1,A2,A3* |
| **S11** | *11* | Neuro-fuzzy Systems | *A1,A2,A3* |
|  | **S12** | *12* | Fuzzy Optimization | *A1,A2,A3* |
|  | **S13** | *13* | Fuzzy Linear and Integer Programming | *A1,A2,A3* |
|  | **S14** | *14* | Applications of Fuzzy Logic |  |  |  |  |  |  |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exam** | *30% Midterm* | *In class Exam* | *If a student misses an exam and provides an acceptable legitimate document, a make-up exam should be provided for the midterm.* |
| **A2** | **Quiz** |  |  |  |
| **A3** | **Homework** | *20%* |  *Take Home* | *No Make-up* |
| **A4** | **Project** | *30%* | Final Project | *No Make-up* |
| **A5** | **Report** | *10%* | Final Report | *No Make-up* |
| **A6** | **Presentation** | *10%* | Final Presentation | *No Make-up* |
| **A7** | **Attendance/ Interaction** |  |  |  |
| **A8** | **Class/Lab./****Field Work** |  |  |  |
| **A9** | **Other** |  |  |  |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | *Letter grades depend on the weighted total of the scores attained from homework, midterm, final, lab work, project according to the weights given above.* |
| **Method for Determining Letter Grade** | *Better Result of a Curve in class or the Catalog System given below:**A+:100 A: 95-99 A-: 90-94**B+: 85-89 B: 80-84 B-: 75-79**C+: 70-74 C: 65-69 C-: 60-64**D+: 55-59 D: 50-54 F:0-50* |
| **Teaching Methods, Student Work Load** | **No** | **Method** | **Explanation** | **Hours** |
| ***Time applied by instructor*** |
| **1** | **Lecture** | *Lecturing and utilizing chalkboard/whiteboard. Sample questions and answers to strengthen learning. In class exams.*  | *14 weeks 3 hours =42* |
| **2** | **Interactive Lecture** | *The instructor stops and asks students questions and encourages them to answer.* |  |
| **3** | **Recitation** | *Problems and solutions are demonstrated on chalkboard/whiteboard.*  |  |
| **4** | **Laboratory** | *Conducting experiments in lab and writing reports.* | *2 weeks 2 hours =4* |
| **5** | **Practical** | *Supervised practical experience in a student’s field of study that provides him/her the opportunity to apply knowledge gained in an academic setting.* |  |
| **6** | **Field Work** | *Students out into the real world to experience new information.*  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** | The problem subject of the project is researched and a report is written.  |  |
| **8** | **Homework** | Answers of given questions are prepared at home.  | *14 weeks 2 hours =28* |
| **9** | **Pre-class Learning of Course Material**  | New subjects are learned by watching videos or reading course notes before class.  | *14 weeks 2 hours =28* |
| **10** | **Review of Course Material** | Review of the subjects before exams in order to prepare.  | *14 weeks 2 hours =28* |
| **11** | **Studio** | Activity leading to skill development of the student’s design or performance ability and/or artistic growth. |  |
| **12** | **Office Hour** | Asking questions to instructor or to the teaching assistant out of class hour. |  |
| **TOTAL** | *180* |
| ***IV. PART*** |
| **Instructor** | **Name** | *Asst. Prof. Dr. Hakan Şimşek* |
| **E-mail** | *hakan.simsek@antalya.edu.tr* |
| **Phone Number** | *0242 245 0185* |
| **Office Number** | *A1-26* |
| **Office Hours** | *2 hrs per week* |
| **Course Materials** | **Mandatory** | **1) S. N. Sivanandam, S. Sumathi and S. N. Deepa, Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.****2) T. J. Ross, Fuzzy logic with engineering applications, 1 ed. New York, NY: McGraw-Hill, 1995**  |
| **Recommended** | **3) H.-J. Zimmermann, Fuzzy set theory and its applications, 3 ed. Norwell, MA: Kluwer, 1996.** |
| **Other** | **Scholastic Honesty** | *Violations of scholastic honesty include, but are not limited to cheating, plagiarizing, fabricating information or citations, facilitating acts of dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Any form of scholastic dishonesty is a serious academic violation and will result in a disciplinary action.* |
| **Students with Disabilities** | *Reasonable accommodations will be made for students with verifiable disabilities.* |
| **Safety Issues**  | *The course does not require any special safety precautions.* |
|  | *Circumstances may arise during the course that prevents the instructor from fulfilling each and every component of this syllabus; therefore, the syllabus is subject to change.  Students will be notified prior to any changes.* |
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