**ITU**

**DERS KATALOG FORMU**

**(Course Catalogue Form)**

| **Dersin Adı:**  Biçimsel Diller ve Otomatlar | **Course Name:**  Formal Languages And Automata |
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| **Kodu (Course Code)** | **Yarıyıl (Semester)** | **Kredisi (Local Credits)** | **AKTS Kredisi (ECTS Credits)** | **Ders Uygulaması, Saat/Hafta** | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Ders (Theoretical)** | **Uygulama (Tutorial/Recitation)** | **Laboratuvar (Laboratory)** |
| BLG311E | 4 | 3 | 5 | 3 | - | - |

| **Bölüm/Program**  **(Department/Program)** | Bilgisayar Mühendisliği / Computer Engineering |
| --- | --- |

| **Dersin Türü**  **(Course Type)** | Temel Bilim  (Basic Science) | **Dersin Dili (Course Language)** | İngilizce  (English) |
| --- | --- | --- | --- |
| **Ders Zorunluluğu (Course Compulsion)** | | Zorunlu (Compulsory) | |

| **Dersin Önkoşulları (Course Prerequisites)** | BLG112/E Discrete Mathematics | | | |
| --- | --- | --- | --- | --- |
| **Dersin Mesleki Bileşene Yüzde Katkısı**  **(Course Category by Content Percentage)** | Temel Bilim  (Basic Science) | Temel Mühendislik (Engineering Science) | Mühendislik Tasarım (Engineering Design) | İnsan ve Toplum Bilim (General Education) |
| 65% | 10% | 25% | - |

| **Dersin İçeriği (Course Description)** | Biçimsel diller. Gramerler ve Chomsky hiyerarşisi. Düzenli ifadeler. Sonlu durum makineleri(FSM): Mealy ve Moore modelleri. Makina eşdeğerliliği ve durum indirgemesi. Deterministik ve deterministik olmayan otomatalar. Yığın yapılı otomatalar ve bağlamdan bağımsız gramerler. Turing makinası ve hesaplanabilirlik. |
| --- | --- |
| Formal languages. Grammars and the Chomsky hierarchy. Regular expressions. Finite state machines (FSM) : Mealy and Moore models. Machine congruence and reduction of states. Deterministic and non deterministic automata. Push down automata and context-free grammars. Turing machines and computability. |
| **Dersin Amacı (Course Objective)** | 1. Sonlu durum makina kavramlarını derinlemesine anlama, 2. Sentaks analizlerini ve çözümleme kavram ve metotlarını derinlemesine anlama, 3. Basit bir derleyici tasarımının temeli |
| 1. A broad understanding of the finite state machine concepts. 2. A broad understanding of syntax analysis and parsing concepts and methods. 3. A knowledge of the basis of compiler design |
| **Dersin Öğrenme Çıktıları (Course Learning Outcomes)** | 1. Sonlu durum makinesi modelinin ve durum makinesi çeşitlerinin öğrenilmesi. 2. Biçimsel dil ve gramer kavramlarının öğrenilmesi, dil tiplerinin kavranması 3. Durum makinesi - dil arası ilişkinin anlaşılması 4. Dil özelliklerinin öğrenilmesi 5. Turing Makinası ve hesaplamalı algoritmaların modellenmesini anlama |
| 1. Learning finite state machine model and finite state machine types. 2. Learning formal language and grammar concepts, understanding of types of languages. 3. Understanding the relation between finite state machines and languages 4. Learning properties of different languages 5. Understanding Turing machines and computation models |

| **Ders Kitabı (Textbook)** | J.E. Hopcroft, R. Motwani, J. D. Ullman, Introduction to Automata Theory, Languages and Computation, Addison Wesley, 2007 |
| --- | --- |
| **Diğer Kaynaklar (Other References)** | Michael Sipser, Introduction to The Theory of Computation, Cengage Learning, 3rd ed. 2013  John C. Martin, Introduction to Languages and The Theory of Computation, McGrawHill, 4th ed. 2011 |

| **Ödevler ve Projeler (Homeworks & Projects)** | - |
| --- | --- |
| - |
| **Laboratuvar Uygulamaları (Laboratory Work)** | - |
| - |
| **Bilgisayar Kullanımı (Computer Use)** | - |
| - |
| **Diğer Uygulamalar (Other Activities)** | - |
| - |

| **Başarı Değerlendirme Sistemi**  **(Assessment Criteria)** | **Faaliyetler (Activities)** | **Adedi (Quantity)** | **Değerlendirmedeki Yüzde Katkısı**  **(Effects on Grading by Percentage)** |
| --- | --- | --- | --- |
| **Yıl İçi Sınavları (Midterm Exams)** | 2 | 50% |
| **Kısa Sınavlar (Quizzes)** | 5 | 10% |
| **Ödevler (Homework)** | - | - |
| **Projeler (Projects)** | - | - |
| **Dönem Ödevi/Projesi (Term Paper/Project)** | - | - |
| **Laboratuvar Uygulaması (Laboratory Work)** | - | - |
| **Diğer Uygulamalar (Other Activities)** | - | - |
| **Final Sınavı (Final Exam)** | 1 | 40% |

**DERS PLANI**

**(Course Plan)**

| **Hafta** | **Konu** | **Dersin Çıktıları** |
| --- | --- | --- |
| **1** | Tanımlar: Sonlu Durum Makineleri, Biçimsel Diller | 1, 2 |
| **2** | Alfabeler, Diller ve Gramerler | 2 |
| **3** | Chomsky Hiyerarşisi, Düzenli İfadeler ve Düzenli Diller | 2 |
| **4** | Bağlamdan Bağımsız Diller ve Ayrıştırma | 2, 4 |
| **5** | Gerekirci ve Gerekmezci Sonlu Otomatlar | 1 |
| **6** | DFA - NFA eşdeğerliği | 1 |
| **7** | Düzenli İfade Tanıma | 1, 3 |
| **8** | Düzenli Diller için Pumping Lemma | 3, 4 |
| **9** | Yığın Yapılı Otomatlar | 1 |
| **10** | PDA - CFG eşdeğerliği | 3, 4 |
| **11** | Bağlamdan Bağımsız Dillerin Özellikleri | 4 |
| **12** | Bağlamdan Bağımsız Diller için Pumping Lemma | 3, 4 |
| **13** | Turing Makinaları | 1, 5 |
| **14** | Karar Verilebilirlik | 5 |

| **Week** | **Topic** | **Course Outcome** |
| --- | --- | --- |
| **1** | Definitions: Finite State Machines, Formal Languages | 1, 2 |
| **2** | Alphabets, Languages and Grammars | 2 |
| **3** | Chomsky Hierarchy, Regular Expressions and Regular Languages | 2 |
| **4** | Context Free Languages and Parsing | 2, 4 |
| **5** | Deterministic and Non-Deterministic Finite Automata | 1 |
| **6** | DFA-NFA Equivalency | 1 |
| **7** | Recognizing Regular Expressions | 1, 3 |
| **8** | Pumping Lemma for Regular Languages | 3, 4 |
| **9** | Push-down Automata | 1 |
| **10** | PDA-CFG Equivalency | 3, 4 |
| **11** | Properties of Context Free Languages | 4 |
| **12** | Push-down Automata for Context Free Languages | 3, 4 |
| **13** | Turing Machines | 1, 5 |
| **14** | Decidability | 5 |

**DERSİN BİLGİSAYAR MÜHENDİSLİĞİ ÖĞRENCİ ÇIKTILARI İLE İLİŞKİSİ**

**Relationship between the Course and Student Outcomes**

**(1: “Little”, 2: “Partial”, 3: “Full”, Leave blank if your answer is “None”)**

| **Computer Engineering Department Program Outcomes and Performance Criteria** | | **Level of Contribution** | | |
| --- | --- | --- | --- | --- |
| **1** | **2** | **3** |
| 1 | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics |  |  | X |
| 2 | an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors |  |  | X |
| 3 | an ability to communicate effectively with a range of audiences |  |  |  |
| 4 | an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts |  |  |  |
| 5 | an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives |  |  |  |
| 6 | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions |  |  |  |
| 7 | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies |  |  |  |

**HAZIRLANMA BİLGİSİ**

**Edition Information**

| **Prepared by** | **Date** | **Signature** |
| --- | --- | --- |
| **Dr.Tolga Ovatman** | **26.11.2020** |  |
| **Approved by** | **Date** | **Signature** |
| **Dr.Tolga Ovatman** | **26.11.2020** |  |