**ITU**

**DERS KATALOG FORMU**

**(Course Catalogue Form)**

| **Dersin Adı:**  Fonksiyonel Programlama | **Course Name:**  Functional Programming |
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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)** |
| BLG458E | 8 | 2 | 4 | 2 | - | - |

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

| **Dersin Türü**  **(Course Type)** | Mühendislik Tasarım  (Engineering Design) | **Dersin Dili (Course Language)** | İngilizce  English |
| --- | --- | --- | --- |
| **Ders Zorunluluğu (Course Compulsion)** | | {Zorunlu / Seçmeli} ({Compulsory / Elective}) | |

| **Dersin Önkoşulları (Course Prerequisites)** | BLG221/E Data Structures  or  BLG223/E Data Structured and Laboratory  or  BLG233/E Data Structures | | | |
| --- | --- | --- | --- | --- |
| **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) |
| - | - | 100% | - |

| **Dersin İçeriği (Course Description)** | Programlama yaklaşımları ve fonksiyonel programlama ilkeleri. Rekürsiyon. Kalıp eşleştirme. Yüksek mertebeden fonksiyonlar. Fonksiyonel veri tipleri. Tembel değerlendirme. Monadlar. |
| --- | --- |
| Programming paradigms and functional programming principles. Recursion. Pattern matching. Higher order functions. Functional data structures. Lazy evaluation. Monads. |
| **Dersin Amacı (Course Objective)** | 1. Öğrencilere fonksiyonel programlama yaklaşımını öğretmek. 2. Çağdaş fonksiyonel programlama dilleri kullanarak öğrencilere rekürsif fonksiyon geliştirmeyi, fonksiyon örtülerini ve tembel değerlendirme tekniğini öğretmek. 3. Fonksiyonel dillerle karşılaştırmalar yaparak öğrencilerin yordamsal programlama yapılarını daha iyi anlamalarını sağlamak. 4. Öğrencilere yordamsal programlamada uygulayabilecekleri fonksiyonel teknikler öğretmek. |
| 1. Teaching students the functional programming paradigm. 2. Teaching students to develop recursive functions, function closures and lazy evaluation using modern functional programming languages. 3. Improving the students' understanding of imperative programming constructs by contrasting them with functional concepts. 4. Teaching students functional programming techniques that they can also apply in imperative programming. |
| **Dersin Öğrenme Çıktıları (Course Learning Outcomes)** | 1. Öğrenciler fonksiyonel programlamanın ilkelerini öğrenir ve önemini anlar. 2. Öğrenciler fonksiyonel bir programlama diliyle küçük ve orta çaplı projeler geliştirebilir. 3. Öğrenciler yapacakları bir projede fonksiyonel programlama gerekip gerekmeyeceğine karar verebilir ve gerekiyorsa bu amaca uygun araçları seçebilir. 4. Öğrenciler fonksiyonel programlama tekniklerini kullanarak yordamsal programlama |
| 1. Students learn the principles of functional programming and understand their significance. 2. Students can develop small- to moderate-sized projects using a functional programming language. 3. Students can judge whether they would need to employ functional programming in a given project and choose the appropriate tools for achieving such a goal. 4. Students can apply functional programming techniques to improve their coding skills in imperative programming platforms. |

| **Ders Kitabı (Textbook)** | Haskell: The Craft of Functional Programming, Simon Thompson, Addison-Wesley, 2011 |
| --- | --- |
| **Diğer Kaynaklar (Other References)** | Structure and Interpretation of Computer Programs, Harold Abelson, Gerald Jay, Sussman, Julie Sussman, MIT Press, 1996 |

| **Ödevler ve Projeler (Homeworks & Projects)** | Fonksiyonel bir programlama dilinde gerçeklenecek programlama ödevleri. |
| --- | --- |
| Programming assignments to be implemented in a functional programming language. |
| **Laboratuvar Uygulamaları (Laboratory Work)** | - |
| - |
| **Bilgisayar Kullanımı (Computer Use)** | Programlama ödevleri bilgisayarda gerçeklenecektir. |
| The programming assignments will be implemented on a computer. |
| **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)** | 1 | 30% |
| **Kısa Sınavlar (Quizzes)** | - | - |
| **Ödevler (Homework)** | - | - |
| **Projeler (Projects)** | 1 | 30% |
| **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** | Programlama Yaklaşımları, İfade Değerlendirme | 1, 3 |
| **2** | Tip Sistemleri, Tip Çıkarsama | 1, 3 |
| **3** | Rekürsiyon, Kuyruk Rekürsiyonu | 1, 2, 4 |
| **4** | Kalıp Eşleştirme | 1, 2, 3 |
| **5** | Yüksek Mertebeden Fonksiyonlar, İsimsiz Fonksiyonlar | 1, 2, 3, 4 |
| **6** | Yüksek Mertebeden Liste Fonksiyonları | 1, 2, 3, 4 |
| **7** | Fonksiyon Örtüleri, Kısmi Uygulama | 1, 2, 3, 4 |
| **8** | Tip Hiyerarşileri | 2, 3 |
| **9** | Çok-şekillilik, Jeneriklik | 1, 2, 3, 4 |
| **10** | Tip Sınıfları | 2, 3 |
| **11** | Fonksiyonel Veri Yapıları | 2, 4 |
| **12** | Derlemeler | 2, 4 |
| **13** | Tembel Değerlendirme | 1, 2 |
| **14** | Monadlar | 1, 2, 3 |

| **Week** | **Topic** | **Course Outcome** |
| --- | --- | --- |
| **1** | Programming Paradigms, Expression Evaluation | 1, 3 |
| **2** | Type Systems, Type Inference | 1, 3 |
| **3** | Recursion, Tail Recursion | 1, 2, 4 |
| **4** | Pattern Matching | 1, 2, 3 |
| **5** | Higher Order Functions, Anonymous Functions | 1, 2, 3, 4 |
| **6** | Higher-Order List Functions | 1, 2, 3, 4 |
| **7** | Function Closures, Partial Application | 1, 2, 3, 4 |
| **8** | Type Hierarchies | 2, 3 |
| **9** | Polymorphism, Generics | 1, 2, 3, 4 |
| **10** | Type Classes | 2, 3 |
| **11** | Functional Data Structures | 2, 4 |
| **12** | Collections | 2, 4 |
| **13** | Lazy Evaluation | 1, 2 |
| **14** | Monads | 1, 2, 3 |

**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.H.Turgut Uyar** | **21.12.2012** |  |
| **Approved by** | **Date** | **Signature** |
| **Dr.Tolga Ovatman** | **07.12.2020** |  |