COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Advanced Topics in Algorithms and Computer Science	CSE 610		3 +0	3	10

Prerequisites	An introductory algorithms course and knowledge of a high level programming language are required.

Language of Instruction	English
Course Level	PhD. Degree
Course Type	
Course Coordinator	
Instructors	Onur Demir
Assistants	
Goals	The goal of the course is to provide advanced techniques for algorithm analysis and advanced data structures. The students will have ability to design and analyze advanced algorithms and data structures for large scale data operations such as string search or packet classification.
Content	Advanced and recent research issues in Algorithms and Computer Science. Amortized and Probabilistic Analysis, Search Trees, Advanced Priority Queues, String Algorithms, Network Algorithms Design Principles, Packet Classification, Prefix Lookup algorithms and data structures.

Learning Outcomes	Program Outcomes	Teaching Methods	Assessment Methods
1. Knows advanced analysis techniques and is able to apply these techniques to analyze advanced data structures.	3,4,5	1,2,3	A,C,D
2. Can analyze data structures and algorithms using amortized analysis and probabilistic analysis techniques.	3,5	1,2	A,C,D
3. Knows network algorithms design principles.	3,5	1,2	A,C,D
4. Can customize data structures and algorithms for different scenarios in networking domain.	3,5	1,2,3	A,C,D

5. Can analyze scientific publications.	4	1,2,3	C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Term Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Review of Basics - Efficiency Analysis, Master Theorem, Algorithmic Techniques	Scientific Papers
2	Amortized Analysis	Scientific Papers
3	Probabilistic Analysis, B-Trees	Scientific Papers
4	Fibonacci Heaps, Relaxed Heaps	Scientific Papers
5	van Emde Boas Trees	Scientific Papers
6	String Search Algorithms 1 - Naive String Search Algorithm, Rabin-Karp	Scientific Papers
7	String Search Algorithms 2 - Knuth-Morris-Pratt, Boyer Moore, Bitap	Scientific Papers
8	Principles of Network Algorithms, Exact Lookup Algorithms	Scientific Papers
9	Prefix Lookup Algorithms Unibit, Multibit, Stride Tries,LC Tries	Scientific Papers
10	Classification Algorithms Grid of Tries, Decision Trees	Scientific Papers
11	Paper Presentations	Scientific Papers
12	Paper Presentations	Scientific Papers
13	Paper Presentations	Scientific Papers
14	Paper Presentations	Scientific Papers

RECOMMENDED SOURCES	
Textbook	Introduction to Algorithms, Cormen et.al., MIT Press, 3rd Edition Network Algorithmics, Varghese, Morgan Kaufman
Additional Resources	Scientific Papers

MATERIAL SHARING	
Documents	

Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Presentation	1	20
Term Project	1	80
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		0
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		100
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Knowledge in the advanced computer architecture field					
2	Knowledge in advanced system design for computer engineering					
3	Knowledge in the theoretical topics of computer science					5
4	Ability to comprehend, analyze and critique academic publications and conduct scholarly research at the frontiers of computer engineering				4	
5	Ability and knowledge in the fields of Next-Generation and contemporary computer networks				4	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Term Project	1	100	100
Paper Presentation	1	20	20

Total Work Load			246
Total Work Load / 25 (h)			9,84
ECTS Credit of the Course			10