Course description:

This course is a prerequisite for many advanced courses in CS study plan and covers a wide range of data structures such as: linked lists, stacks, queues, binary trees, binary search trees and heaps. Hash tables and dictionaries are also included. All the presented techniques are implemented using selected programming language such as java.

Aims and Objectives:

Students are expected to:

- Gain an understanding of different data structures such as linked lists, queues, stacks and trees.
- Have the ability to select an appropriate data structure for a specified application.
- Be able to solve problems using suitable data structures and write programs for these problems.
- Understand how the choice of data structures impacts the performance of programs

Intended Learning Outcomes (ILOs):

Upon successful completion of this course, students will be able to:

A. Knowledge and Understanding	
A1	**Concepts and Theories:** • Understand the role of abstraction in the design of data structures and algorithms. • Know and describe different types of data structures • Compare the relative advantages of different data structures.
A2	**Contemporary Trends, Problems and Research:** Propose new data structures that can serve real life applications.
A3	**Professional Responsibility:** Abide by laws and regulations of software development

B. Subject-specific skills	
B1	**Problem solving skills:** Use analytic skills to analyze problems at hand and determine the appropriate solutions.
B2	**Modeling and Design:** • Use abstract data types to design new applications using predefined data types (ready-made components) • Use Binary search trees to build efficient dictionaries and maps.
B3	**Application of Methods and Tools**: Implement designed solutions using computer programming languages

C. Critical-Thinking Skills	
C1	**Analytic skills:** Use analytic skills to analyze problems at hand and determine the appropriate data structure(s)
C2	**Strategic Thinking:** Use strategic thinking to propose efficient solutions for complex problems

C3	**Creative thinking and innovation**: Use creative thinking and innovation to mix different data structures and propose efficient solutions for complex problems

D. General and Transferable Skills (other skills relevant to employability and personal development)	
D1	**Communication:** Express and communicate ideas in written and oral forms.
D2	**Teamwork and Leadership:** Be cooperative members of a team
D3	**Organizational and Developmental Skills:** Plan for automating of systems
D4	**Ethical and Social Responsibility:** Understand that they are accountable for their actions and there must be a balance between economic growth and the welfare of the society and environment**.**

Course Structure:

Week	Hours	ILO's	Topic	Teaching Procedure	Assessment methods
1	3	A1	Introduction to data structures and abstract data types Lists - Array Lists abstract data type	Lecturing with active participation, quizzes, team learning.	Homework, quizzes, reports
2	3	A1, B1	Lists – Array List implementation List applications	=	=
3, 4	6	B1, B2,B3	Lists – Linked Lists – pointer data type Singly-Linked Linked lists operations Singly-Linked Linked List implementation Doubly-Linked Lists Circularly-Singly-Linked Lists	=	=
5	3	B1, B2,B3	Stack abstract data type Stack implementation – Array Stack	=	=
			First Exam		
6	3	A1,B1, B2,B3, C1,C2, C3, D1,D2, D3,D4	Stack implementation – Linked Stack Stack applications: Expressions and Infix-to-postfix conversion	=	=
7, 8	6	A1,A2, A3, B1,B1, B2,C1, C2,C3, D1,D2, D3,D4	Queue Abstract data type Stack – Queue Operations Queue implementation – Array Queue Queue implementation – Linked Queue Queue applications: Radix sort	=	=
			Second Exam		
9, 10	6	A1,A2,	General Tree Abstract data type	=	=

		A3,B1, B2,B3, C1,C2, C3, D1,D2, D3,D4	General Tree examples General Tree implementation		
11	3	A1,A2, A3,B1, B2, B3 ,C1,C2, C3,D1, D2,D3, D4	Binary Tree Abstract data type Binary Tree examples Binary Tree implementation	=	=
12, 13	6	A1, A2,A3, C1,C2, C3,B1, D1,D2, D3,D4	Binary Expression Tree Binary Search Tree Heaps	=	=
14, 15	6	A1,A2, A3,B1, B2,B3, D1,D2, D3,D4	Maps and Dictionaries Hash Tables	=	=
			Final Examination		

References:

Main Textbook:

Micheal T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser,"Data Structure and Algorithms in Java", 6th edition, John Wiley and Sons; 2014.

A. **Supplementary textbook(s), websites**

- Mark A. Weiss, "Data Structures and Problem Solving using Java" (4th edition), Addison-Wesley Publishing Co., 2010.
- John Lewis, Peter DePasquleans Joe Chase, "Java Foundations: Introduction to Program Design and Data Structures", Addison-Wesley, 2008.

Assessment Methods:

Methods	Grade	Date
First Exam	20%	
Second Exam	20%	
Assignments (Reports \Quizzes\ Seminar \ Tutorials ….)	10%	
Final Examination	50%	