Program	Level	First cycle
	Name of the program	Theoretical Computer Science

COURSE

Course title	**Data Structures and Algorithms**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
CS 210	III	Mandatory course/Elective course	7	3+2+2
Lecturer				
Course Goals	This course introduces some basic data structures (arrays, linked lists, stacks, queues, trees and heaps) and algorithms (various sorting algorithms, and algorithms for operations on binary search trees and heaps).			
Learning Outcomes	Upon successful completion of this course, student should be able to: - define basic static and dynamic data structures and relevant standard algorithms for them: stack, queue, dynamic linked lists, trees, graphs, heap, priority queue, hash tables, sorting algorithms, min-max algorithm, - demonstrate advantages and disadvantages of specific algorithms and data structures, - select basic data structures and algorithms for autonomous realization of simple programs or program parts			

COURSE CONTENT

- Introduction to Algorithms, Algorithm analysis, Complexity of an algorithm. Asymptotic notations;
- Classical sequential sorting algorithms (bubble sort, selection sort, insertion sort, shell sort, quick sort, radix sort, external sort)
- Searching algorithms (sequential search, binary search, binary tree search, external search, interpolation search, Fibonacci search);
- Divide-and-conquer
- The concept of data structure. Types of data structures. Linear and branched data structures.
- Linear data structures. Arrays and Linked List. Stacks and Queues. Implementation. Singly Linked and Doubly-linked lists; Static and Dynamic Implementation;
- Branched data structures. Three. Binary Search Trees. Static and Dynamic Implementation; Application of trees;
- Heaps. Heap sort. Hash tables and hashing;
- Graphs and graph algorithms, Breadth First Search (BFS), Depth First Search (DFS),
- Shortest-path algorithms (Dijkstra's and Floyd's algorithms)
- Minimum spanning tree (Prim's and Kruskal's algorithms)
- Ford-Fulkerson Algorithm for Maximum Flow and Applications

LITERATURE

[1] Notes and slides from lectures
[2] T. H. Cormen, C. E. Leiseron, R. L. Rivest & C. Stein, Introduction to Algorithms, MIT Press, 2009.
[3] Robert Sedgewick and Kevin Wayne, Algorithms, 4th Edition, Addison Wesley Publishing, 2011.
[4] A. Drozdek, Data Structures and Algorithms in C++, Course Technology; 3 edition, 2004
[5] M. Živanović, Algoritmi, Matematički fakultet, Beograd, 2000.
[6] Milo Tomašević, Algoritmi i strukture podataka, Akademska misao, Beograd, 2008.
[7] V. Aho, J. E. Hopcroft, J. D. Ulman: Data Structures and Algorithms, Addison-Wesley, 1983.
[8] D. E. Knuth, The Art of Computer Programming, Volume 1: Fundamental Algorithms, Addison-Wesley, 1968.

STUDENT WORKLOAD (hours in a semester)

Lectures	45	Exercises	60	Individual work	70	T o t a l	175

GRADING			**REMARKS**
Criterion	Maximum	Minimum	

	points	points
Midterm exams	30	15
Projects and homeworks	20	10
Final exam	50	25
T o t a l	100	55