Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MAT231	Algorithms and Advanced Programming I	3	1	1	1	3	3

Prerequisites	
Admission Requirements	

Language of Instruction	French
Course Type	Compulsory
Course Level	Bachelor Degree
Objective	The purpose of this course is to improve students programming capabilities by the study of some common algorithms, their implementations and their applications to sample computational problems.
Content	Programming review (with Python): variables and state, conditionals, loops, functions Basic data structures: list, multi dimensional array, tree Common algorithms: search, sort, aggregate functions Recursion: numeric computation, tree traversal (inorder/preorder/postorder) Algorithm Analysis: time/space complexity classes
References	The Art of Computer Programming - Donald Knuth Python - How to Program - Deitel Data Structures and Algorithms Using Python - Rance D. Necaise Data Structures and Algorithms with Object-Oriented Design Patterns in Python - Bruno R.Preiss

Theory Topics

Week	Weekly Contents
1	Programming review: value, expression, variable, data type, assignment, program state, enumerating loops
2	Programming review: conditionals, execution branching, conditional loops, nested loops and conditionals
3	Programming review: functions, parameters, return value, code flow, stack frames, variable scope
4	Sequences, patterns, multidimensional patterns from loop indices, data dependence
5	Implementing aggregate functions: min, max, sum, count, avg, std.dev, unique
6	Sorting values on a list: naive approach, insertion sort, bubble sort, merge sort
7	Midterm I
8	Recursion: depth bounding, flow of function calls, examples: factorial, fibonacci, quick sort
9	Trees: depth first, breadth first traversal, in-order/pre-order/post-order traversal
10	Stack, Queue, relation of stack with recursion, recursion removal
11	Midterm II
12	Numerical algorithms: random number generation, root finding, linear regression
13	Search: simple search, binary search, searching recursively
14	Time/space complexity, Complexity classes, comparison of algorithms