Program	Level	Second cycle		
	Name of the program	Theoretical Computer Science		
COURSE				
Course title	**Computational Geometry**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
CS 440	I	Mandatory course	7	3+0+2
Lecturer				
Course Goals	This course aims to introduce the students to advanced geometric algorithms and their applications in solving complex geometric problems.			
Learning Outcomes	At the end of this course, a student should rule with advanced geometric techniques from computational geometry.			

COURSE CONTENT

- The algorithms for calculation of the 3D Convex Hull (CH). The minimum weight triangulation (MWT) and its original properties and definitions.
- The randomized algorithms of searching for determination of minimum weight triangulation. Binary search trees (BSP) and their construction.
- Painter's algorithm. The size of BSP in 3D space. Application of BSP on the scene. Algorithms for removing invisible surfaces using BSPs.
- The properties and characteristics of the Voronoi diagram and Delaunay triangulation. The data structures for computing the Voronoi diagram and its dual. The determining of the Voronoi Diagram by using Fortune's algorithm. The application of the Flip-edge algorithm to find Delaunay triangulation. The connection between Delaunay triangulation and Voronoi diagram.
- The movement of a robot. Medial axes. Sum of Minkowski. Convolution of the curves. The convergence of curves. CRUST algorithm for reconstruction of curves based on usage: Voronoi diagram, Delaunay triangulation, and the medial axes.
- Polyhedra and their fundamental properties. Gauss-Bonnet theorem and Cauchy's rigidity theorem.
- Robotic Arm. The polygonal spaces of motion. Square trees. A recursive algorithm for dividing points in a plane.
- The concept of a network and an algorithm for its calculation.
- Visibility graphs and their calculation. The finding of shortest paths while moving robots in space.

LITERATURE

[1] 1. Franco P. Preparata, Michael lan Shamos, Computational geometry, An Introducion, (1985), Springer Verlag.

[2] 2. Mark de Berg, Marc van Kreveld, Mark Overmars, Otfried Schwarzkopf, Computational Geometry, Algorithms and Applications, 3rd edition, (2008), Springer Verlag.

[3] 3. Satyan L. Devadoss, Joseph O' Rourke, Discrete and Computational Geometry, (2011), Princeton University Press

[4] Jacob Goodman and Joseph O'Rourke, Handbook of Discrete and Computational Geometry, 2nd edition, CRC Press, 2004.

STUDENT WORKLOAD (hours in a semester)

Lectures	45	Exercises	30	Individual work	100	T o t a l	175

GRADING			**REMARKS**
Criterion	Maximum points	Minimum points	
Midterm exams	30	16	
Projects	40	22	
Final exam	30	17	

Total	100	55	