Program	Level of studies		First cycle		
	Program name		**Physics**		
Course name	**FUNDAMENTALS OF CHAOS THEORY**				
Course ID	Semester	Course status	ECTS credits		L+E
PTH6421	**VI**	**ELECTIVE**	**4**		**2+1**
Lecturer	**Prof. dr. Aner Čerkić**				
Aims and intended learning outcomes	Aim of the course is to introduce students into basic ideas of the deterministic chaos theory. Expected outcomes: Adopting the basic ideas and concepts of the deterministic chaos theory. Mastering the mathematical apparatus of the deterministic chaos theory. Getting acquainted with the applications of the deterministic chaos theory to real physical systems.				

Course content
Qualitative dynamics

Vector fields as dynamical systems
Some definitions of vector fields and their integral curves. Equilibrium positions and linearization of vector fields. Stability of equilibrium positions. Critical points of Hamiltonian vector fields. Stability and instability of the free top.
Long-term behaviour of dynamical flows and dependence on external parameters
Flows in phase space. More general criteria for stability. Attractors. The Poincare mapping. Bifurcations of flows at critical points. Bifurcation of periodic orbits.
Deterministic chaos
Iterative mappings in one dimension. Qualitative definitions of deterministic chaos. An example: The logistic equation.
Quantitative measures of deterministic chaos
Routes to chaos. Liapunov characteristic exponents. Strange attractors.
Chaotic motions in celestial mechanics
Rotational dynamics of planetary satellites. Orbital dynamics of asteroids with chaotic behavior.

Student workload (hours)		Grading	
Lectures and Exercises	45	Assessment method	Points
Exam preparation	40		
Assignments	10		
Other	5	Midterm exam	50
Total	100	Final exam	50
		Total	100

Literature

Mandatory literature:
   1. F. Scheck, *Mechanics - From Newton's Laws to Deterministic Chaos*, Springer-Verlag, Berlin, 2005.
Additional literature:
   1. S. Nettel, *Wave physics. Oscillations – Solitons – Chaos*, Springer, Berlin, 1997.
   2. P. Davies (editor), *The New Physics*, University Press, Cambridge, 1989.
   3. H. J. Korsch, H.-J. Jodl, *Chaos. A program collection for the PC*, Springer, Berlin, drugo izdanje, 1998.
   4. M. R. Belić, *Deterministički haos*, Sveske fizičkih nauka, III (3), Beograd, 1990.

Remarks