SYLLABUS

Level of study	Master's Course

Course title in Ukraine	Теоретическая механіка		
Course title in English	Theoretical mechanics		
Course code		ECTS credits	4
Lecturer(s)	Dr hab. Tomasz Dobrowolski, prof. UP		

Course objectives (learning outcomes)	This course aims to get students acquainted with knowledge of laws, issues and concepts of classical mechanics. The course concentrates on knowledge of mechanical system description in Euler-Lagrange, Hamilton and Hamilton-Jacobi formulations.

Prerequisites:

Knowledge	Knowledge of algebra and mathematical analysis.
Skills	Ability to differentiate, integrate, solve ordinary and partial differential equations, transform tensors.
Courses completed	Mathematical Analysis, Algebra.

Learning effects:

	Learning effects of the course	Relation of the learning effects to the specialization
Knowledge	**W01** A student knows the Newton's laws of motion. **W02** A student knows the least action principle in configuration space. A student understands the concept of symmetry and knows the Noether theorem. **W03** A student knows description of motion in the phase space and the Hamilton formalism. **W04** A student knows Hamilton Jacobi equation. **W05** A student knows the concept of chaos.	K_W01 – K_W05

	Learning effects of the course	Relation of the learning effects to the specialization
Skills	**U01** A student applies the Neton's laws in solving mechanical problems. **U02** A student constructs the action for variety of mechanical systems, obtains Euler-Lagrange equations and solve them. **U03** A student constructs hamiltonian for mechanical systems, obtains Hamilton equations of motion and solves them. A student applies canonical transformations in order to simplify description of the system. A student constructs the algebra of integrals of motion with use of the Poisson theorem. **U04** A student can solve Hamilton-Jacobi equation via additive separation of variables. **U05** A student can study properties of simple maps and calculates volume dimension for simple fractal systems.	K_U01 – K_U05

	Learning effects of the course	Relation of the learning effects to the specialization
Social skills	**K01**. A student has the creativity and the ability to conceptual thinking. **K02** A student is able to present and justify the personal point of view. **K03** A student is able to use the aquired knowledge and skills for the communication with the scientific community. **K04** A student is aimed to expand personal knowledge and skills. **K05** A student has the legal erudition.	K_K01 – K_K05

Course organization:

Form of classes	Lecture (W)	Group-exercises										
		A (large group)		K (small group)		L (Lab)		S (Seminar)		P (Project)		E (Exam)	
Contact hours	30			30									
Semester	1												
Language	English												

Teaching methods:

The course consists of open for discussion and questions lectures and classes.
In-class exercises are designed to probe knowledge with emphasis on how well students have understood the underlying topics of the course.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
W01								x	x				
W02								x	x				
W03								x	x				
W04								x	x				
U01						x	x	x	x				
U02						x	x	x	x				
U03						x	x	x	x				
U04						x	x	x	x				
K01							x	x	x				
K02							x	x	x				
K03							x	x	x				
K04							x	x	x			x	
K05							x	x				x	
K06							x	x				x	

Assessment criteria:

Grades	The grading scale will be as follows: 90 – 100 % - **A** including **A**- **excellent** (eq. in Ukraine:відмінно (very good)) 82–89 % : **B** including **B** – **very good** (eq. in Ukraine: добре (good)) 74–81 %: **C** including **C** - **good** (eq. in Ukraine: добре (good)) 64–73 %: **D** including **D** – **satisfactory** (eq. in Ukraine: задовільно (satisfactory)) 60–63 %: **E** including **E** – **acceptable** (eq. in Ukraine: задовільно (satisfactory)) < 59 %: **F failded** (eq. in Ukraine: незадовільно (unsatisfactory))
Criteria	**A.** A student knows all terms and concepts mentioned in W1-W5, U1- U5 and K1-K5. A student can work without any assistances, his/her knowledge's are creative and easily applied to decision of specific problem. **B.** A student knows all terms and concepts mentioned in W1-W5, U1- U5 and K1-K5, yet needs a little help when decision of specific problem. **C.** A student knows all terms and concepts mentioned in W1-W5, U1- U5 and K1-K5, however needs a help when decision of specific problem. **D.** A student knows the most of terms and concepts mentioned in W1-W5, U1- U5 and K1-K5 and has difficulty in decision of specific problem. **E.** A student knows only several terms and concepts mentioned in W1-W5, U1- U5 and K1-K5 and can solve only a simple problem. **F.** A student does not know most of terms and concepts mentioned in W1-W5, he/she did not reach the satisfactory level of knowledge this course.

Course content (topic list):

Topics	W01 Newton's laws of motion.
	W02 The Lagrange formalism.
	W03 Description of motion in the phase space - the Hamilton formalism.
	W04 Hamilton-Jacobi equation.
	W05 General dynamical systems and chaos.

Literature:

Compulsory reading	L.D.Landau, J.M.Lifshitz "Theoretical Physics. Mechanics."
Recommended reading	H. Goldstein, C.P. Poole, J.L. Safko, "Classical Mechanics."

Estimation of the total working time of students:

Contact hours	Lectures	30
	Seminars	30
	Other (consultation, meetings)	10
Students' work hours (without the lecturer)	Reading books and preparation for the lectures	10
	Preparation to the seminar	10
	Preparation of an individual presentation	10
	Preparation to the exam	
Total works' hours		100
ECTS credits		4