Course Title (in English)	Hamiltonian mechanics
Course Title (in Russian)	Гамильтонова механика
Lead Instructor(s)	Marshakov, Andrei

Status of this Syllabus	The syllabus is a work in progress (draft)
Contact Person	Andrei Marshakov
Contact Person's E-mail	andrei.marshakov@gmail.com

1. Annotation

Course Description	

This is the first among the base courses in the theoretical physics, aimed for the master
students.

Matematical methods of modern theory of Hamiltonian systems are based on the concepts,
arosen in different fields of mathematics: differential equations and dynamical systems,
Lie groups and algebras, differential geometry on manifolds. Many modern directions in
mathematics (e.g. symplectic geometry) got their origin from the problems of classical
mechanics.This course is recommended to all students, interested in mathematical physics,
and it does not imply any special preliminary education in physics.

The preliminary program of the course includes:
1. Lagrangian formalism: minimal action principle, Euler-Lagrange equations, symmetries
and integrals of motion, Noether theorem.
2. Simplest examples: dynamics for a single degree of freedom, Kepler's problem etc.
3. Basis of the Hamiltonian formalism: phase space, Legebdre transform, Hamilton equations,
the Poisson and symplectic structures, Darboux theorem.
4. The Hamilton-Jacobi equation, canonical transform, Liouville theorem.
5. Integrable systems: separation of variables, Liouville integrability. Systems with Lax
representation.
6. Examples of integrable systems: Toda and Calogero problems, integrable systems on Lie
groups, geometry of spectral curves etc.

2. Structure and Content

Course Academic Level	Master-level
Number of ECTS credits	6

3. Assignments

4. Grading

Type of Assessment	Graded

Grade Structure

Activity Type	Activity weight, %
Attendance	
Final Exam	

Grading Scale

A:	86
B:	76
C:	66

D:	56
E:	46
F:	0

5. Basic Information

Course Stream	Science, Technology and Engineering (STE)
Course Term (in context of Academic Year)	Term 1 Term 2 Term 3 Term 4
Course Delivery Frequency	Every year

Students of Which Programs do You Recommend to Consider this Course as an Elective?

Masters Programs	PhD Programs
Mathematical and Theoretical Physics Photonics and Quantum Materials	Mathematics and Mechanics Physics

Please List the Teaching Assistants (TAs) You Propose for Your Course

First Name	Last Name
Vladimir	Poberezhny

Course Tags	Math Physics

6. Textbooks and Internet Resources

Required Textbooks	ISBN-13 (or ISBN-10)
Mathematical Methods of Classical Mechanics, V.I.Arnold 2nd edition	9780387968902

7. Facilities

8. Learning Outcomes

Do you want to specify outcomes in another framework?	Knowledge-Skill-Experience is good enough

9. Assessment Criteria

10. Additional Notes