The Hebrew University of Jerusalem

Syllabus

Analytical Mechanics - 77303

Last update 03-09-2018

<u>HU Credits:</u> 6

<u>Degree/Cycle:</u> 1st degree (Bachelor)

<u>Responsible Department:</u> Physics

<u>Academic year:</u> 0

<u>Semester:</u> 1st Semester

<u>Teaching Languages:</u> Hebrew

<u>Campus:</u> E. Safra

<u>Course/Module Coordinator:</u> Prof Barak Kol

<u>Coordinator Email:</u> barak_kol@phys.huji.ac.il

<u>Coordinator Office Hours:</u> By appointment

<u>Teaching Staff:</u>

Prof Barak Kol
Mr. Gadi Mintz
Mr. Linial Itai

Course/Module description:
A course in analytical mechanics

Course/Module aims:
See learning outcomes

Learning outcomes - On successful completion of this module, students should be able to:
Solve mechanics problems using Lagrangian and Hamiltonian formalisms.

Attendance requirements(%):
0

Teaching arrangement and method of instruction: Lecture and recitation and problem sets.

Course/Module Content:
The course will describe advanced analytical methods in mechanics developed in the 18th-19th centuries, namely the Lagrangian (action) formulation and the Hamiltonian (phase space) formulation. These methods supplement the Newtonian formulation both conceptually and in problem solving abilities. In addition they play a key role in 20th century physical theories including quantum mechanics and field theory.
Subjects within the Lagrangian formulation: Index calculus (mathematical preparation), generalized coordinates, Lagrangian formulation, variational calculus, and the action; elementary examples for action level analysis; equilibrium points and small oscillations; symmetry and conservation laws (Noether's theorem); elimination of a cyclic coordinate at the level of the action; Legendre transform and Lagrange multipliers. The two-body problem. Perturbation theory.
Hamiltonian formulation: Hamiltonian and Hamilton's equations, phase space; symplectic structure and Poisson brackets; the oscillator in the a, a* basis; spin dependent interactions. Hamilton-Jacoby equation and separation of variables.

Required Reading:

None

 Additional Reading Material:
• *הקורס מבוסס על רשימות הקורס המבוססות בתורן על הספרים שבהמשך. חומרים מסוימים של*
  הקורס יופיעו באתר הקורס במערכת moodle http://moodle.huji.ac.il .
• *Classical Mechanics, H. Goldstein,C. Poole and J. Safko (2002)*
• *Mechanics, Landau & Lifshitz (1960)*
• *Analytical Mechanics, L. Hand and J. Finch (1998)*
)

 Course/Module evaluation:
 End of year written/oral examination 90 %
 Presentation 0 %
 Participation in Tutorials 0 %
 Project work 0 %
 Assignments 10 %
 Reports 0 %
 Research project 0 %
 Quizzes 0 %
 Other 0 %

Additional information:
 None