האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Analytical Mechanics - 77303

Last update 28-10-2020

HU Credits: *6*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *Physics*

Academic year: *0*

Semester: *1st Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Dr Michael Moshe*

Coordinator Email: *michael.moshe@mail.huji.ac.il*

Coordinator Office Hours: *By appointment*

Teaching Staff:

Dr. Michael Moshe,
Mr. Linial Itai,
Mr. Gadi Mintz

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(%):
90

Teaching arrangement and method of instruction: Lecture and recitation, problem sets and short weekly quizzes.

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: Newtonian Mechanics, 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. 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 80 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 10 %
Reports 0 %
Research project 0 %
Quizzes 10 %
Other 0 %

Additional information:

Grade consists of 12 points from weekly quizzes, 13 points from weekly problem sets, and 80 points from final exam.
If morbidity condition would not allow an examination in campus, final exam format will be based on either home exam and an online exam.