האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Analytical Mechanics - 77303

Last update 08-09-2024

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. Rivka Bekenstein*

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

Coordinator Office Hours: *Monday 0900*

Teaching Staff:

Dr. Rivka Bekenstein,
Ms. Noemie Livne,
Mr. Ariel Kelman

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(%):
NA

Teaching arrangement and method of instruction: Lecture and recitation, and weekly 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: 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)
)

Grading Scheme:

Written / Oral / Practical Exam 90 %
Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 10 %

Additional information: