האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Advanced Quantum Theory 1 - 77800

Last update 25-01-2024

HU Credits: 4

Degree/Cycle: 2nd degree (Master)

Responsible Department: Physics

Academic year: 0

Semester: 1st Semester

Teaching Languages: English and Hebrew

Campus: E. Safra

Course/Module Coordinator: Prof. Barak Kol

Coordinator Email: barak.kol@mail.huji.ac.il

Coordinator Office Hours: Sundays at 2pm, by appointment

Teaching Staff:

Prof Barak Kol,
Mr. khalaf Majed

Course/Module description:
The course deals with a number of topics in quantum mechanics beyond the undergraduate level. Emphasis is put on description and analysis of systems with many degrees of freedom.

Course/Module aims:
The course shall prepare the student for courses and research on quantum optics and atomic physics, on discrete and continuous condensed matter systems and on quantum field theory and high energy physics.

Learning outcomes - On successful completion of this module, students should be able to:
understand the theory of the photon, determine decay rates for excited energy levels of the hydrogen atom, be familiar with entanglement, determine the effective potential for slow degrees of freedom after averaging over fast ones, be familiar with the Dirac equation, determine fine-structure splitting of atomic levels, analyze supersymmetric systems.

Attendance requirements(%):
0

Teaching arrangement and method of instruction: Lecture, Exercise

Course/Module Content:
Atoms and radiation: the photon, atomic transitions.
Many-body notions: entanglement, fast-slow approximation (Born-Oppenheimer).
Relativistic spin (Dirac equation): fine-structure of atomic spectrum, anti-particles, gyromagnetic ratio.
Inspiring notions: path integral formulation and propagator, supersymmetric quantum mechanics.

Required Reading:
None

Additional Reading Material:

Landau and Lifshitz - Quantum Mechanics.

Sakurai - Advanced Quantum Mechanics.

Grading Scheme:

Written / Oral / Practical Exam 80 %

Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 20 %

Additional information: