



The Hebrew University of Jerusalem

Syllabus

Quantum Technologies - 77891

Last update 06-03-2025

HU Credits: 4

Degree/Cycle: 2nd degree (Master)

Responsible Department: Physics

Academic year: 0

Semester: 2nd Semester

Teaching Languages: English and Hebrew

Campus: E. Safra

Course/Module Coordinator: Dr. Shlomi Kotler

Coordinator Email: shlomi.kotler@mail.huji.ac.il

Coordinator Office Hours: By appointment

Teaching Staff:

Course/Module description:

The ability to manipulate quantum degrees of freedom is at various stages of transitioning from lab experiments to technological applications. In this course we will explore the basic ideas and review the candidates for these technologies. In particular we will focus on quantum computing with trapped ions, circuit- and cavity-QED, and quantum optomechanics.

Course/Module aims:

Quantum technologies is a fast growing and changing field. This course will give the students the basic skills required to start doing research in the field.

Learning outcomes - On successful completion of this module, students should be able to:

Understand the advantages and disadvantages of various technological implementations of quantum hardware.

Attendance requirements(%):

0

Teaching arrangement and method of instruction: Lectures

Course/Module Content:

1. Introduction and background
2. Review of the quantum two-level system, the Bloch equations, Rabi oscillations
3. Basic structure of hydrogenlike atoms used in quantum technologies. Example: The atomic clock
4. Dissipation in quantum systems, the Lindblad master equations, relaxation operators
5. Trapped ions
6. Interaction with quantized fields: the Jaynes-Cummings Hamiltonian
7. Basics of superconducting qubits
8. Optomechanics (time permitting).

Required Reading:

Will be given during the course.

Additional Reading Material:

Will be given during the course.

Grading Scheme:

Written / Oral / Practical Exam 85 %

Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 15 %

Additional information: