

Syllabus

## QUANTUM THEORY IN APPLIED PHYSICS - 83880

Last update 28-10-2015

<u>HU Credits:</u> 5

Responsible Department: applied physics

<u>Academic year:</u> 0

Semester: 2nd Semester

Teaching Languages: Hebrew

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

Course/Module Coordinator: Prof. Ronen Rapaport

Coordinator Email: paltiel@mail.huji.ac.il

Coordinator Office Hours: Prof. Ronen Rapaport

<u>Teaching Staff:</u> Prof Ronen Rapaport Mr. Cohen Eyal

Course/Module description:

Basic concepts.

Non-locality and Bell inequalities. Pure and mixed quantum states. The density matrix. The dipole approximation, Optical Bloch equations, and the interaction of a 2-level atom with a clasicall EM field. Idensical particles, symmetries of the manyparticle wavefunction. Variational method and the Helium atom. Exchange density and energy. Hrtree and Hartree-Fock approximations, interacting electrons in a metal. Second quantization. light-matter interaction and the quantization of the electromagnetic field and the photon.

Spontaneous and stimulated emission.

Particle under external electric and magnetic field. The Aharonov-Bohm effect and the Quantum Hall effect.

For each subjects possible applications will be discussed.

<u>Course/Module aims:</u> See learning outcomes

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

Advanced knowledge quantum physics, identical many particle physics, Second quantization And applications

<u>Attendance requirements(%):</u> 0

Teaching arrangement and method of instruction: Frontal lecture + Exercise

## Course/Module Content:

Basic concepts.

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Spontaneous and stimulated emission.

Particle under external electric and magnetic field. The Aharonov-Bohm effect and the Quantum Hall effect.

For each subjects possible applications will be discussed.

<u>Required Reading:</u> NA

<u>Additional Reading Material:</u> Formalistic books: ] J. J. Sakurai, Modern Quantum Mechanics ] Albert Messiah, Quantum Mechanics

*General* [] *Leonard Schiff, Quantum Mechanics* [] *Gordon Baym, Lectures on Quantum Mechanics* 

*Quantum Optics* [] A Yariv, *Quantum Electronics* [] C Cohen-Tanoudji et. al., Atom-Photon Interactions [] L Mandel & E Wolf, Optical Coherence and Quatum Optics [] MO Scully & MS Zubairy, *Quantum Optics* 

*Applied Quantum Mechanics Herbert Kroemer, Quantum Mechanic for Engineering: Materials Science and Applied Physics* 

Web http://aphquantum.weebly.com

Course/Module evaluation: End of year written/oral examination 0 % Presentation 80 % Participation in Tutorials 0 % Project work 0 % Assignments 20 % Reports 0 % Research project 0 % Quizzes 0 % Other 0 % <u>Additional information:</u> NA