Syllabus

Name of course: Integrated Photonics

Course number: 377.2.5599

Reception hours: Requested in advance

Lecturer: Prof. Alina Karbachevsky

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Course description:

Driven by the dream of untapped device functionality, integrated photonics studies the emerging science of the interaction of light with matter while the light is guided on a chip. The aim is to control lightfast (within only a few oscillation cycles of the light wave), in a miniature device containing only a few layers of atoms using signals carried by only a few photons. The proposed course will encompass fundamental theoretical basics of integrated photonic circuitry, computational physics (numerical modeling of complex integrated systems), concepts of design and fabrication routines of actual devices and principles of experimental verifications of their performances. The course program relies on two major directions: (1) Physical phenomena, manipulated on a chip by waveguides, with applications in biomedical devices and optics communication. (2) Light-matter interactions on nanoscale with composite plasmonic waveguides.

Aims of the course:

1. Introduces the fundamentals of photonics waveguides as a basic element of Integrated Photonics circuitry.
2. Introduces the concepts of Integrated Photonics design considerations.
3. To equip the student with the theoretical background to design, characterize and analyze the Integrated Photonics devices and systems.

Milestones of the course:

1. Acquire the students with the basics of integrated photonics in terms of electromagnetism under electrostatic approximation.
2. Acquire the students with the principles of the design considerations.
3. Acquire the students with the theory of composite plasmonic waveguides.
4. Acquire the students with the main fabrication routines of Integrated Photonic devices.
5. Acquire the students with Maxwell Solver techniques for guided-wave optics calculations, mode profiling, propagation constants, losses, the evolution of the hybrid guided modes, evanescent fields distributions, surface intensity and transmitted power.

Assessments:

30% Test (בוחן)

30% Simulation

20% Presentation

20% Homework + participation

Scientific presentation task:

Scientific presentation: study and presentation of a recently published article: theory, design considerations, experimental apparatus and application demonstrated - 45 min.

Light-on-a-Chip Group
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