# Nano-materials and nano-technology for sustainable energy 001-2-4050

**3 credits course, Prof. Iris Visoly-Fisher**

**Objectives:**

- The student will acquire the background needed to understand current state-of-the-art research in the field of Nano-Science and technology, specifically those related to NanoEnergy.
- The student will gain experience in research presentation.

**Detailed course description (schedule is tentative):**

Students are expected to complement their background on topics and concepts mentioned in class if they are not familiar with them. Guidance can be provided upon request.

- Introduction to nanoscience and nanotechnology (weeks 1-5): Overview and Feynman's lecture. Quantum mechanics and electronics, nanomaterials.
- Tools (weeks 6-9): top down and bottom up fabrication of nanostructures. Electron microscopy, scanning probe microscopy.
- NanoEnergy applications (weeks 10-14): specific examples. Topics can be selected according to the fields of interest of the course participants. The topics may include:

- Nano in solar energy conversion: Nanoparticles for light harvesting, Third generation photovoltaics, thermophotovoltaics, thermoelectrics – principles, figure of merit, advantages of nanomaterials.
- Nanomaterials in catalysis for alternative fuels and water purification, transport in liquid media and environmental nano-toxicity, (photo)catalysis for impurity oxidation on metal-oxide and hybrid nano-particles.
- Energy storage: Nano-materials and nano-structured electrodes in batteries and fuel cells.
- Quantum concepts for sustainable energy: multiple exciton generation (MEG), hot electrons, up- and down-light conversion, intermediate band PV, luminescent solar concentrator, modeling and catalyst simulation.
- Nanotechnology for Energy efficient devices: quantum computing, miniaturization, NEMs.

**Suggested literature:**

1. Introduction to Nanoscience, Stuart Lindsay, Oxford Press, 2009.
2. Nanostructured Materials for Solar Energy Conversion, ed. by T. Soga, Elsevier, 2006.
3. Nanophysics and Nanotechnology – an introduction to modern concepts in nanoscience, Edward L. Wolf, Wiley-VCH, 2004.
4. Recent relevant journal papers - TBD

**Grading:**

Weekly homework assignments – 50%. Homework will be presented in class. Presentation of application – 50%