S-104.3610 Nanotechnology (5 cr) **Exam 12.5.2009**

Please answer either in English or Finnish.

1. Explain briefly (max. 2 pages altogether, draw schematics if needed):
   a) basics of EUV lithography
   b) microcontact printing (μcp)
   c) how geckos can climb on walls?
   d) break-junction technique in molecular electronics
   e) fabrication of 3D photonic crystals
   f) GMR effect
   (each 1 p)

2. Structure and properties of carbon nanotubes. (6 p)

3. a) Compare so called "top-down" and "bottom-up" methodologies. What are the advantages and difficulties in each approach? (3 p)
   b) Importance of high-k oxides in CMOS transistors. (3 p)

4. a) Growth process of atomic layer deposition (ALD). (3 p)
   b) CVD production of carbon nanotubes. (3 p)

5. Principles of scanning tunneling microscopy (STM) and atomic force microscopy (AFM). (6 p)