S-104.3610 Nanotechnology (5 cr) **Exam 18.5.2010**

Please answer either in English or Finnish.

1. Explain briefly (max. 2 pages altogether, draw schematics if needed):
   a) electron beam lithography
   b) nanoimprint lithography
   c) 2D photonic crystal
   d) graphene
   e) GMR effect
   f) lotus leaf effect
   (each 1 p)

2. Chirality in carbon nanotubes and its effect on the material properties. (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) From MEMS to NEMS in applications, why it is difficult? (3 p)

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