Nanotechnology

1 - Introduction to Nanotechnology.
- What is it?
- Size dependent properties.
- Surface effects: Surface energies and surface tensions. Surface reactivity and catalysis.
- Quantum effects: Tunneling, quantum confinement...

2 - Nanomaterials.
- Nanoparticles.
- Colloids.
- Porous materials.

3 - Characterization techniques.
- IR, Raman, UV-VIS, Fluorescence, Confocal, DRX, XPS, Synchrotron.
- SEM, TEM, EDX.
- Tunnel effect techniques, AFM and related techniques.

4 - Reactivity of surfaces.
- Gas–solid reactions.
- Infrared Spectroscopy with probe molecules and HREELS.
- Sensors and catalysis.
- Surface reconstruction.

5 - Fabrication and preparation.
- Top-down and bottom-up.
- Lithographies: Optical (UV, DUV), e-beam litho, AFM based litho, Nanoimprint.
- Growth of films.

6 - Organic Optoelectronic Nanostructures.
- Organic PV.
- Molecular FET.

7 - Nanoelectronics.
- Confinement; Density of states.
- MOS revisited and scaling down
- UTB and FINFET
- Quantum conductance
- Resonant Tunneling and devices.
- High performance lasers

Evaluation:
Written exam + Work-term reports on specific topics
Partial exam (EP) (35%) + Final Exam (EF) (35%) + Presentation of the report (PT) (30%)

Bibliography
- "Introduction to Surface Chemistry and Catalysis" Gabor A. Somorjai
  John Wiley and Sons Ltd 2005
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