

CML734: Nanostructured Materials (3-0-0) Jul-Dec 2018

LH 520 (Mon and Thursday 9.30 to 10.50 AM)

1. Introduction to the course (1)
2. Fundamentals of Nanomaterials: Introduction, quantum mechanics and atomic structure, Bonding and band structure, (3)
3. Size controlled properties: Optical, electronic and magnetic properties of nanostructured materials.(2)
4. Surface energy, surface crystallography, surface reconfigurations, surface area and surface thermodynamics, colloidal chemistry, nanoparticle nucleation and growth. (2)
5. Assembly: Hydrogen bonding -based assembly, electrostatic assembly, shape-selective assembly, hydrophobic assembly, collective properties of self-assembled nanoparticles. (3)
6. 0 D nanomaterials: Metal nanoparticles, Semiconductor nanoparticles, oxide materials (1)
7. 1 D nanomaterials: Nanowires ; 2 D nanomaterials: Nanosheets(1)
8. Discussion : (1)

S. Nos 1 – 8 : 14 lectures (by Dr S. Sapra)

9. Synthesis and fabrication of Nanomaterials: co-precipitation, sol-gel process, micro-emulsions, hydrothermal methods, templated synthesis. (2)
10. Characterization techniques: Optical, structural (XRD), Electronic (XPS), microscopy (TEM, SEM, AFM, STM) (5)
11. Carbon based nanomaterials: fullerenes, CNTs, graphene – synthesis, selected properties (2)
12. Applications: Nanoelectronic materials, single electron transistors, single electron capacitors, quantum effects in transistors, carbon nanotube based electronic devices, spintronics, ----- biosensors (4)
13. Discussion : 1

S. Nos 9 – 13 : 14 lectures (by Dr A K Ganguli)

Instructors:

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Recommended books

1. Fundamentals and Applications of Nanomaterials, Zhen guo & Li Tan, Artec House publication 2009.
2. The physics and chemistry of Nanosolids, Frank J. Owens & Charles P. Poole Jr., Wiley-Interscience publication 2008.
3. Nanostructures and Nanomaterials, Guozhong Cao and Ying Wang, World Scientific
4. Nanoparticles, G. Schmid, Wiley-VCH

Grading

Minor 1: 20 marks

Minor 2: 20 marks

Major: 40 marks

Surprise quizzes: 20 marks (there will be a few surprise quizzes during lectures)

GRADE POLICY: Those who secure >80% will be awarded 'A' Grade. Minimum 30% mark is required to obtain 'D' GRADE.

Attendance:

As per Institute rules, 75% attendance is compulsory. Anyone who falls short of 75% attendance will be awarded ONE GRADE LESS than what they actually deserve as per their obtained marks.