PHY 665 - Nanophysics and Nanotechnology

Course Code & Number	Course Name	C.H.	Lec.	Lab.	Tut.
PHY 665	Nanophysics and Nanotechnology	4	4	0	0

Syllabus

Generalities on Nanoscience and Nanotechnology: *History of nanosciences, fundamental concepts (bottom-up and top-down), Importance of nanosystems, Specific surface area and quantization.*

Synthesis Techniques of Nanomaterials: *Introduction on nanofabrication, Generalities on germination techniques, Chemical methods like reduction of metallic salts, Electrochemical reduction, Sol-gel technique, Solvothermal technique, Core-schell systems and in-situ synthesis. Physical methods like thermal evaporation, PLD, electric discharge, sputtering, MBE, CVD, MOCVD and lithography.*

Quantization (3D, 2D, 1D and 0D): *Gas of free electron, energy levels for free electron, energy densities in 3D, 2D, 1D and 0D. Bohr radius. Effective energy band-gap.*

Porosity and Texture of Nanomaterials: *Porous material, Equation of Guswitsch, textural characterization by adsorption-desorption, adsorption isotherms, specific surface area, porous volume and pores distribution.*

Characterization Techniques of Nanomaterials: *Scanning probe microscopies, scanning (SEM) and transmission electron microscopy (TEM), optical spectroscopy and electrical techniques.*

Some Technological Applications: *nanoelectronic components. Quantum effects in opto-electronic materials and photocatalytic processes. The quantum effects will be discussed, as well as recent developments. In addition, fundamental processes in nanostructured semiconductors, such as used in novel, sensitized solar-cells will be studied.*

References

- E.L. Wolf, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, 2nd Edition, Wiley, 2006.
- C. Binns, Introduction to Nanoscience and Nanotechnology, Wiley, 2010.
- G. Cao and Y. Wang, Nanostructures and Nanomaterials: Synthesis, Properties and Applications, 2nd Edition; World Scientific, 2011.