

4 th Semester	RCH4D003	Principles and Application of Nanotechnology	L-T-P 3-0-0	3 CREDITS
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Objectives:

The objective of this course is to focus on the nanoscale properties and to give an overview of the exciting advancement in this area.

Module-I : (10 hrs)

Introduction to nanotechnology, definition, history. What makes the nanoscale so different from the other length scales by considering the under pinning science (i.e.nanoscience) and some key examples of nanotechnology.

Module-II : (10 hrs)

Properties in nanoscale: Extensive and Intensive properties, change in physical properties like color, melting point, electrical, magnetic, and mechanical. Quantum mechanical approach to explain the properties change in nanoscale.

Module-III : (07 hrs)

Theory of size dependent melting point, effect of grain size and grain boundary on mechanical properties of nanomaterial's.

Module-IV : (08 hrs)

Methods of synthesis of nanomaterials fabrication-“Top-down” vs. “bottom-up” approaches. A brief idea on synthesis of different nanomaterial's. Theory of nucleation and growth.

Module-V : (10 hrs)

Brief introduction to application of nanoparticles in catalysis, biotechnology, sensor etc.Characterization of nanoparticles by Scanning probe microscopes (Atomic Force Microscopy, Scanning Tunneling Microscopy), Transmission Electron Microscopy, Scanning Electron Microscopy.

Books:

- S. K. Kulkarni, *Nanotechnology Principles and Practices*, Capital Publishing Co. , 2007
- B. Rogers, S. Pennathur, J. Adams, *Nanotechnology: Understanding small systems*, Taylor and Francis, , 2008.
- Tang, Zikang and Sheng, Ping, *Nano science and technology: novel structures and phenomena*, Taylor and Francis, , 2003
- M. Rieth, *Nano-Engineering in Science and Technology: An Introduction to the World of Nanodesign*, World Scientific, , 2003