



# Birla Institute of Technology & Science, Pilani

Hyderabad Campus

## INSTRUCTION DIVISION FIRST SEMESTER 2019 - 2020

### Course Handout Part II

18.07.2019

In addition to part-I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course No. : BITS F416  
Course Title : Introduction to Nanoscience  
Instructors : V. SATYA NARAYANA MURTHY; B. Harihara Venkataraman

**Course Description:** Introduction; Nanoscience in Nature; Fundamental science behind nanomaterials; Synthesis and properties of nanomaterials; Tools to study the properties, Size and shape determinations, Application of nanomaterials in Science and Engineering; Future trend.

**Scope & Objectives:** This is a course for the science and engineering students to introduce the concept of Nanoscience at a basic level. It shows that nanomaterials are there in nature in abundance. Proper appreciation and unfolding them can lead to various fruitful applications in Sciences, as well as in Engineering. The various techniques (conventional and ultra-modern) to synthesize and study nanomaterials are covered. The course ends with the direction towards which the field of Nanoscience is growing at the moment.

**Text Books:** G L Hornyak, J. Dutta, H. F. Tibbals and A. K. Rao, Introduction to Nanoscience, CRC press 2008.  
G L Hornyak, J. J. Moore, H. F. Tibbals and J. Dutta, Fundamentals of Nanotechnology, CRC press 2009.  
Relevant research articles and textbooks related to the content of this course will also be referred.

**References:** F. J. Owens, *Introduction to Nanotechnology*, Wiley Intescience 2003; G. L. Hornyak, S. M. Lindsay, *Introduction to Nanoscience*, Oxford University Press, 2010; C. P. Poole Jr. and Frank J. Owens, Wiley-India, 2009.

### **Learning Outcomes:**

- Basic Science required to understand the physical and chemical properties of nanomaterials
- Ability to identify fabrication methods to prepare nanoparticles
- Ability to identify the correct experimental tools to characterize nanomaterials

### **Course Plan:**

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the text book
1 - 2	Introduction	What is Nanoscience? Societal and Ethical implications of Nanoscience;	Chapter 1 & Lecture notes



		Environmental Implications; Advanced Materials; Future of Nanotechnology	
3 - 12	Nanophenomenon in Nature and Science behind Nanoscience	Lycurgus cup, Lotus effect, Materials, Structure and the Nanosurface; Energy at the nanoscale; Thermodynamics in nanomaterials; Chemical interactions at the nanoscale; Basic quantum mechanics and Solid state Physics	Chapter 2, 6 & Lecture notes
13 - 17	Characterization and analysis	Scanning Tunneling microscopy and Scanning Probe Microscopy	Chapter 3 & Lecture notes
17 - 21	Special Topic	Nano-magnetism	Lecture notes
22 - 25	Physics : Properties and Phenomena	Materials, Structure and Nanosurface (General Perspective)	Chapter 5 & Lecture notes
26 - 29	Fabrication Methods	Fabrication routes to synthesize nanomaterials/ nanocomposites	Lecture notes
30 - 36	Characterization of Nanomaterials	<ul style="list-style-type: none"> <li>Structural determination of Nanomaterials by X - ray diffractometer</li> <li>Microstructural Analysis of Nanomaterials (Size and Shape determination) by Transmission/Scanning electron microscopy</li> </ul>	Chapter 3 & Lecture notes
37 - 40	Special Topic	Nano crystal composites and its applications	Lecture notes
41 - 42	Future Trend	Future prospects of nanomaterials in science and engineering applications	Lecture notes

**Evaluation Scheme:**

EC No.	Evaluation Component.	Duration	Weightage	Date, Time & Venue	Nature of Component
1	Mid-Sem	90 min.	35%		Closed Book
2	Quiz 1 & 2	40 min.	20%		Open Book
3	Comprehensive Examination	3 Hours.	45%		Closed book

**Chamber Consultation Hour:** To be announced in the class.

**Notices:** Notices concerning the course will be put up on the **Physics notice board**.

No makeup for quiz.

Instructor-in-charge

