



**FIRST SEMESTER 2021 - 2022**

**Course Handout Part II**

20.08.2021

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 : **B. HARIHARA VENKATARAMAN**; V. Satya narayanamurthy

**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. (TB1)\*  
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 Interscience 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.

\* Textbook 1

**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:**

<b>Lecture No.</b>	<b>Learning Objectives</b>	<b>Topics to be covered</b>	<b>Chapter in the text book</b>
1 - 2	Introduction	What is Nanoscience? Societal and Ethical implications of Nanoscience; Environmental Implications; Advanced Materials; Future of Nanotechnology	Chapter 1 (TB1) & Lecture notes
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 (TB1) & Lecture notes
13 - 17	Characterization and analysis	Scanning Tunneling microscopy and Scanning Probe Microscopy	Chapter 3 (TB1) & Lecture notes
18 - 21	Special Topic	Nano-magnetism	Lecture notes
22 - 25	Physics : Properties and Phenomena	Materials, Structure and Nanosurface (General Perspective)	Chapter 5 (TB1) & 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 (TB1) & 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 Scheme	Duration	Weightage (%)	Date & Time	Nature of Component
1	Midsem Examination	90 min	35	23/10/2021 9.00 - 10.30AM	Open Book
2	2 Quizzes	30 min	25	To be announced in the class	Open Book
3	Comprehensive Examination	120 min	40	27/12 AN	Open Book

Chamber Consultation Hour: To be announced in the class.

Notices: Notices concerning the course will be put up in **CMS**.

**Make-up Policy:** Make up will be given strictly to **genuine cases only** i.e. (i) Sickness leading to hospitalization, (ii) Out of station with prior intimation & permission.

**No make-up for Quiz.**

**Academic honesty and integrity policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge  
B. HARIHARA VENKATARAMAN

