Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2022 - 2023
Course Handout Part II

29.08.2022

In addition to the 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 Venkatraman

***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 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, H. F. Tibbals, J. Dutta, H. F. Tibbals and J. J. Moore, Introduction to Nanoscience and Nanotechnology, CRC press 2009. (TB1)*
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.

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:

Lectur	Learning	Topics to be covered	Chapter in the text

e No.	Objectives		book
1 - 2	Introduction	What is Nanoscience? Societal, Ethical, and Environmental Implications	Chapter 1 (TB1) & Lecture notes
3 - 4	Nanoscience in nature	The butterfly effect, Lycurgus cup, Lotus effect, Gecko feet, etc.	Chapter 13 (TB1) & Lecture notes
5 - 6	Nano in the past	Lycurgus Cup, Damascus sword, etc	Chapter 13 (TB1) & Lecture notes
7 - 12	Science behind Nano	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 1	Scanning Tunneling microscopy and Scanning Probe Microscopy	Chapter 3 (TB1) & Lecture notes
18 - 21	Special Topic1	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 and analysis 2	Structural determination of Nanomaterials by X-ray diffractometer Microstructural Analysis of Nanomaterials (Size and Shape determination) by Transmission/Scanning electron microscopy	Chapter 3 (TB1) & Lecture notes
37 - 40	Special Topic 2	Nanocrystal composites and their applications	Lecture notes
41 - 42	Future Trends	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	02/11 9.00 - 10.30AM	Closed Book

2	2 Quizzes (best 1 out of 2)	30 min	25	To be announced in the class	Open Book
3	Comprehensive Examination	180 min	40	22/12 FN	Closed 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 only to Sickness leading to hospitalization.
No make-up for Quizzes.
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
V. Satya Narayana Murthy