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**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:**

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| **Lecture**  **No.** | **Learning Objectives** | **Topics to be covered** | **Chapter in the text 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:***

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| **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 toSickness 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