

**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**  
**HYDERABAD CAMPUS**  
FIRST SEMESTER 2016-2017  
**Course Handout (Part - II)**

**Date: 01/08/2016**

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

Course No. : **CHEM F336**  
Course Title : **Nanochemistry**  
Instructor-in-charge : **Dr. Balaji Gopalan**

**Course Description:** Introduction, importance of nanoscience, chemistry behind nano; Instruments to be used for characterizing nanomaterials; Diversity in nanosystems: chemical aspects of metallic, semiconducting nanomaterials, nanocomposites, carbon nanotubes and fullerenes, self-assembled monolayers, monolayer protected metal nanomaterials, core-shell nanomaterials; Applications of nano materials in nanobiology, nanosensors and nanomedicines, hands on experience in laboratory.

**Scope & Objectives:** This is an elective course for chemistry discipline. Nanomaterials are ubiquitous in nature. Understanding the properties and its dependence on shape, size, and functional groups enables us to employ these nanomaterials for device applications. We will introduce the various nanosystems, study their properties and applications. Applications are limited in the fields of biology, sensors, medicine, and machines. The course also provides an opportunity to learn the synthetic techniques of nanomaterials, characterizations, familiar with various equipments etc.

**Text Book :** T. Pradeep, Nano: The Essentials, Understanding nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

**Reference Book :** 1) C. P. Poole Jr. and F. J. Owens, Introduction to Nanotechnology, Wiley Interscience 2003.

2) S. M. Lindsay, Introduction to Nanoscience, Oxford, 2010

3) G. Cao, Nanostructures and Nanomaterials, Imperial College press, 2004

4) Nanomaterials, B. Viswanathan Narosa Publishing House, New Delhi

Lect. No.	Learning Objectives	Topics to be covered	Reference to Text book
1	Introduction	Nano the beginning, concept, importance	Class note
2-5	Instruments for the characterization of nanomaterials	Electron microscopes, Scanning probe microscope, X-ray diffractometer, Dynamic light scattering	T1 2.1 – 2.6 Class notes
6-11	Metal nanoparticles: syntheses, characterization, properties, applications	Syntheses, properties of monolayer and polymer capped metal nanoparticles, Mie theory, controlling the size and composition of the metallic cores of nanoparticles, Sensoric and photoelectrochemical applications, catalysis, Anisotropic metal nanoparticle, Nanostructure: 2D array, 3D Superlattice	T1 8.1 – 8.6 T1 9.1 – 9.5
12-17	Semiconducting nanoparticles: Syntheses, properties,	Quantum dots, Electronic structure, Semiconductor nanoparticle polymer	T1 7.1 – 7.6

	characterization and applications	composite, Optical properties	
18-21	Nanocomposite materials	What are composite materials; Classification of nanocomposites: Nonpolymer based nanocomposites; Polymer based composites; Biocomposites	Class notes
22-26	Sell-assembled monolayers	Monolayers on gold, patterning monolayers, Langmuir Blodgett films, Applications of films in LED, Non-linear optical properties	T1 5.1 – 5.7
27-29	Carbon nanotubes	Syntheses, Structures, physical properties, Electronic properties, Mechanical Properties and applications	T1 4.1 – 4.9
30-32	Fullerenes	Syntheses and purification, Properties, Nanostructured fullerene films, Applications in electrocatalytic aspects and photoelectrical conversion of light energy	T1 3.1 3.12
33-36	Nanoparticles in catalysis	Introduction of nanoparticles in catalysis, Methods of preparation of supported metal nanoparticles, Applications of nanomaterials in various fields of catalysis	Class notes
37-42	Nanoparticles in Biological and biomimetic applications	Colloidal gold bioconjugates, Metal cluster conjugates, DNA and nanoparticles, DNA recognition, Biomimetic applications: Carbohydrate-protein and carbohydrate-carbohydrate interactions, Nanomaterials as delivery systems	T1 11.1 – 11.7 T1 13.1 – 13.7

**Evaluation Scheme :**

EC No.	Evaluation Component.	Duration	Weightage	Date, Time & Venue.	Nature of Component.
1	Test -1	60 min	15%	13/9, 2.30--3.30PM	Closed Book
2	Test-2	60 min	15%	21/10, 2.30--3.30PM	Closed Book
3	Lab component	-----	20%	-----	Open component
4	Quiz	-----	10%	-----	Closed Book
5	Comprehensive Examination	3h	40%	13/12 AN	Closed Book

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

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

**Make-up Policy:** Make-up for the tests will be granted only on genuine grounds of sickness leading to hospitalization (**should be supported by medical documents**) etc.

Balaji Gopalan  
Instructor-in-charge