K. J. SOMAIYA COLLEGE OF SCIENCE AND COMMERCE , AUTONOMOUS

Certificate course Introduction to Nano science and Nano technology

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Course Details

Department of Physics
2019-2020

This document contains the structure of course, details of syllabus and evaluation pattern.

Course Details

- **Course type** : Certificate
- **Course Title** : Introduction to Nanoscience and Nanotechnology
- **Preamble** :

In recent years nanotechnology is being used successively in almost all areas of science and engineering. The existing application areas include various engineering fields like mechanical, Electronics, Electrical, Civil and also in the fields of information technology, food, agriculture, advanced materials, textile, bio-technology, robotics, transportation, defence, national security, medicine, health, aerospace, energy, environment and many more.

Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. It is about nanoscale science, engineering and technology that involve imaging, measuring, modeling, and manipulating matter at this length scale. Most of the work done in this direction results into novel products and useful commodities.

The research in the field of Nanotechnology is directed toward understanding and creating improved materials, devices and systems.

This syllabus is drafted in such a way that students are made aware of history of nanoscience to the recent advancements. The course also takes care of balancing theoretical and practical components for better understanding and clarity of concepts.

- **Objectives of course** :

1. Learn the wide range of applications of nanotechnology and its interdisciplinary aspect.
2. Learn the principles governing the effect of size on material properties at the nanoscale,
3. Synthesizing biomolecules, and how these principles can be applied to design new biomolecules and bio-nano devices.
4. Gain a working knowledge in nanotechnology techniques (synthesis, fabrication, characterization)
5. Correlate the impact of nanotechnology and nanoscience in a global, economic, environmental and societal context.
6. Identify career paths at the interface of nanotechnology, biology, environmental and agricultural engineering and medicine.

❖ **Prerequisites / Eligibility Criteria :**

This course is designed for undergraduate students interested in working on the applications of nanotechnology to biological, medical, environmental or agricultural/food applications. Students should have studied Physics, Chemistry and Biology at Higher secondary level.

❖ **Intake Capacity :** 30 students per batch

❖ **Course Coordinator** : Dr. Geeta Nair
Ms. Smita Survase

❖ **Syllabus :**

(2 credits)			
Unit	Content	No.of lect	Credit
1	Introduction to nanotechnology Definition of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challenges of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties. One dimensional, two dimensional and three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.	06	01
	Synthesis of nanomaterials Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE	09	
2	Characterization Techniques I: Diffraction analyses: X-ray diffraction, powder diffraction, lattice parameters, structure, analyses, strain analyses, phase identification, particle size analyses using - Scherer`s formula X-ray photoelectron spectroscopy	07	

	(XPS)- Auger electron spectroscopy (AES).		01
	Characterization Techniques II: Surface Imaging: Scanning Electron Microscope (SEM) – Field Emission Scanning Electron, Microscope (FESEM)- Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy, (STM)– Transmission Electron Microscopy (TEM). Spectroscopic techniques: Infra red spectroscopy (IR) – Rotational & Vibrational - UV-visible, Raman Spectroscopy- Photoluminescence (PL)– Cathode luminescence (CL).	08	

❖ **Evaluation Pattern :**

Internal Assessment:

Evaluation type	Marks
Class Test and Assignment	30 + 10

External Assessment:

There will be exam at the end of the course of 60 marks.

❖ **Reference Books :**

1. Textbook of Nanosciene and Nanotechnology by Murthy Raj Shankar Rath Murd
2. Nanotechnology an Introduction to Synthesis Properties and Applications of Nanomaterials by Thomas Verghese and K.M.Balkrishna.
3. Nanophysics and Nanotechnology by Wolf Edward