# GOVERNMENT GENERAL DEGREE COLLEGE AT SALBONI

Koyma, Bhimpur, Paschim Medinipur-721516, West Bengal

**Session: 2019-20**

## Value Added Course
## on
## INTRODUCTION TO NANO MATERIALS AND NANO TECHNOLOGY

**Duration: 30 Hours**

### Course Description

This certificate course provides a comprehensive introduction to the fascinating world of nano materials and nano technology. It covers the fundamental concepts, synthesis, characterization, and applications of nano materials. Participants will explore the unique properties of materials at the nano scale, understand the various techniques used to create and analyze nano materials, and learn their potential applications in various fields everyday devices.

### Course Objectives

- Understand the Fundamental Concepts and Nano scale Phenomena.
- Explore Synthesis and Characterization Techniques.
- Explore applications of nano phenomena in nature and Applications of Nanotechnology in life.
- Learn practical laboratory skills for synthesis and characterisation through hands-on laboratory work.
- Enhance awareness of safety issues related to Ethical, Environmental, and Safety Issues.

### Course Outline

1. Introduction to Nanomaterials and Nano Technology
2. Properties of low dimensional system
3. Size dependent properties of Nano Materials
4. Synthesis of Nano Materials.
5. Physics and Chemistry of Nano materials.
6. Characterization techniques.
7. Application of Nano Materials.
8. Hands-on and Demonstration for analysis method.

### Mode of assessment

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| 1. Class attendance | : 25 | 2. Seminar/Assignment | : 25 |
| 3. MCQ Examination | : 50 | Total | : 100 |

**Course offer to: Students of science streams**

**Course Coordinator: Dr. Some Nath Dey**

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# INTRODUCTION TO NANO MATERIALS AND NANO TECHNOLOGY



## Course Outline

1. **Introduction to Nano materials and Nano Technology (4 hours)**
   Overview of basics of crystalline material, crystalline, amorphous. Poros and nano porus materials
2. **Properties of low dimensional systems. (4 hours)**
   Quantum Confinement , Increased Surface-to-Volume Ratio , Enhanced Mechanical Properties , Optical Properties , Distinct Thermal Properties , Tunable Physical Properties .
3. **Size dependent properties of nano materials (4 hours)**
   Chemical properties: Reactivity; Catalysis. Thermal property: Melting point temperature. Electronic properties: Electrical conduction. Optical properties: Absorption and scattering of light.
4. **Physics and Chemistry of nano materials (4 hours)**
   Low dimensional systems - density of states in semiconductor materials. Quantum wells, self-assembled quantum dots. Colloidal quantum dots. Exciton. quantum dot lasers. Quantum wire devices. Ideal 1DES – semiconductor.
5. **Synthesis of nano materials by Chemical Reduction process (6 hours)**
   Metal nanoparticles. Properties of individual nanoparticles. Consequences of small particle size.
6. **Characterization techniques of nano materials (6 hours)**
   X-ray diffraction. Determination of particle size by X-Ray Analysis. Rietveld analysis and XRDPPA. Identification of materials. Spectroscopic methods - UV-Visible. Electron spectroscopy.
7. **Application of nano materials and nano technology (4 Hours)**
   Silver nanoparticles have good antibacterial properties. ZnO nanoparticles are used in electronics, ultraviolet (UV) light emitters, piezoelectric devices and chemical sensors. TiO2 nanoparticles are used as photocatalyst and sunscreen cosmetics (UV blocking pigment). Tin-Oxide (ITO) nanoparticles are used in car windows, liquid crystal displays and in solar cell preparations

## Course Delivery

- Interactive lectures with chalk and talk method and ICT.
- Various demonstration using multimedia presentations.
- Hands-on activities and demonstrations.
- Group discussions and students seminars for better understanding and idea sharing
- Access to relevant resources, manuals, and reference materials

## Resource Persons

1. Dr. Some Nath Dey, Asst. Professor in Physics, GGDC, Salboni
2. Dr. Sk. Anirban, Asst. Professor in Physics, GGDC, Salboni

## Certification

Participants who successfully complete the course and fulfil assessment criteria will receive a certificate.

## Prerequisites

The course is specified for students for Science discipline only. Basic understanding of Solid-state physics and mathematics recommended. Participants should bring a notebook and pen for note-taking during lectures and activities.