



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3153623**

**Semester- V**

**Subject Name: Nano Materials & Technology**

**Type of course:** Chemical Technology

**Prerequisite:** The students should have knowledge of a Nano Materials.

**Rationale:** The objective of this core course is to provide study and application of extremely small things and can be used across the engineering.

**Teaching and Examination Scheme:**

| Teaching Scheme |   |   | Credits<br>C | Examination Marks |        |                 |        | Total<br>Marks |
|-----------------|---|---|--------------|-------------------|--------|-----------------|--------|----------------|
| L               | T | P |              | Theory Marks      |        | Practical Marks |        |                |
|                 |   |   |              | ESE (E)           | PA (M) | ESE (V)         | PA (I) |                |
| 3               | 0 | 0 | 3            | 70                | 30     | 00              | 00     | 100            |

**Content:**

| Sr. No. | Content  | Total<br>Hrs |
|---------|--|--------------|
| 1       | <b>Introduction to Nano Materials &amp; Technology:</b> Definitions, Fundamental concepts of Nano materials and Nano Technology, Importance of Nano particles, classification of Nano materials and Nano Technologies, basic concept of quantum dots, quantum wires and Quantum tubes      | 08           |
| 2       | <b>Nano Materials:</b> Definition of Nano material, surface effects, quantum effects, Nano scale effect on properties, size dependent properties of Nano materials, classification of Nano materials, Importance of Nano materials, Applications of Nano materials.                        | 08           |
| 3       | <b>Nano materials - synthesis and processing:</b> Mechanical grinding, Wet chemical synthesis; Sol-gel process, Gas Phase synthesis, Plasma processing, Laser ablation, laser pyrolysis, ball milling etc.   | 12           |
| 4       | <b>Advantages, Disadvantages and Applications of Nano materials:</b> Advantages, Disadvantages and Applications of Nano materials, Carbon nanotubes, catalysis, Phosphors for high definitions TV, Computer chips, Pollutants elimination, cosmetics,                                      | 06           |
| 5       | <b>Techniques for measuring Nano materials :</b> Optical microscopes, electron microscopes, surface analysis, elemental analysis, Instruments like atomic force microscopy (AFM), scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-Ray Diffraction (XRD) etc. | 08           |
| 6       | Applications and case study of Nano Technology in Pharmaceutical, Dyes & Pigments, Polymer & Rubber and Glass & ceramics Technology.   | 08           |

**Suggested Specification table with Marks (Theory): (For BE only)**



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| Distribution of Theory Marks |         |         |         |         |         |
|------------------------------|---------|---------|---------|---------|---------|
| R Level                      | U Level | A Level | N Level | E Level | C Level |
| 20                           | 20      | 15      | 15      | 10      | 20      |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Text Books:

- 1) Chemistry of Nanomaterials: Synthesis, properties and applications, CNR Rao et. al.
- 2) Fundamental Properties of Nanostructured Materials, Ed. D. Fiorani (World Scientific, Singapore, (1994).
- 3) Nanostructured Materials and Nanotechnology – II, Eds. Sanjay Mathur and Mrityunjay Singh, Wiley, 2008.
- 4) Nanostructured Materials, Edited by Carl C. Koch, Noyes Publications, New York,

### Reference books:

- 1) Ferziger, J. H., Numerical Methods for Engineering Applications, 2nd ed., WileyInterscience (1998).
- 2) Computational Physics, J. M. Thijssen, Cambridge University Press, Cambridge, (1999).
- 3) Active Metals: Preparation, characterization, applications – A. Furstner, Ed., VCH, New York ,1996.
- 4) Characterization of Nanophase materials – Z.L Wang (ed), Wiley-VCH, New York, 2000.
- 5) Nanoparticles: From theory to applications – G. Schmidt, Wiley Weinheim , 200

### Course Outcomes:

| Sr. No. | CO statement   | Marks % weightage |
|---------|--|-------------------|
| CO-1    | To introduce the fundamentals concept of Nano materials & technology.    | 10                |
| CO-2    | To study the Nano materials with its properties and applications.        | 15                |
| CO-3    | To synthesized and processing of methods of Nano materials               | 20                |
| CO-4    | To know the Advantages, Disadvantages and Applications of Nano materials | 5                 |
| CO-5    | To identify the structure and morphology techniques of Nano materials    | 25                |
| CO-6    | To apply the knowledge of Nano Technology in chemical industry.          | 25                |



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**List of Open Source Software/learning website:**

1. NPTEL
2. MIT Open course lecture available on Internet etc
3. Delnet

**List of Open Source Software/learning website:**

1. Chemical weekly
2. Scifinder online
3. Science direct
4. espacenet
5. Delnet