



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS / B.TECH (CHE-NEW) / SEM-8 / CHE-804A / 2011**

**2011**

## **NANOTECHNOLOGY**

*Time Allotted : 3 Hours*

*Full Marks : 70*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

### **GROUP – A**

#### **( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) Size of a nanoparticle is

- |                  |                  |
|------------------|------------------|
| a) $10^{-10}$ m  | b) $10^{-9}$ m   |
| c) $10^{-10}$ cm | d) $10^{-9}$ mm. |

- ii) A silver nanoparticle solution absorbs light in the region

- |            |        |
|------------|--------|
| a) visible | b) UV  |
| c) near IR | d) IR. |

- iii) Fullerenes are

- |             |                |
|-------------|----------------|
| a) $C_{60}$ | b) $C_{100}$   |
| c) $C_{10}$ | d) $C_{500}$ . |

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- iv) The term 'doping' in nanotechnology is used in connection with
- a) medical applications      b) sound insulation  
c) nanoelectronics          d) nanosensors.
- v) The sol-gel process is mostly used for making
- a) gold nanoparticles      b) carbon black  
c) metal oxides              d) none of these.
- vi) Which one of the following is an inherently conducting polymer ?
- a) Polystyrene                  b) Polyethylene  
c) Polyaniline                  d) Poly vinyl chloride.
- vii) The term 'nanolithography' is used in
- a) improvement of mechanical property  
b) sound insulation  
c) thermal insulation  
d) electronic circuits imprinting.
- viii) Which material is stronger than steel, lighter than aluminium and more conductive ?
- a) Carbon nanotubes      b) Molybdenum  
c) Chromium                  d) Silver.
- ix) Nanoparticles find application in
- a) lithography                  b) fuel cell  
c) catalysis                      d) all of these.
- x) The pore size of the nanofiltration membranes are typically between
- a) 10-20 A                      b) 50-100 A  
c) 100-500 A                  d) 1-2A.

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- xi) Hardness of copper nanoparticles increases with
- decrease of particle size
  - increase of particle size
  - first increase and then decrease of particle size
  - first decrease and then increase of particle size.
- xii) Compared to bulk, melting temperature of 3-4 nm size gold nanoparticles
- drastically reduced
  - drastically increased
  - slightly increased
  - not affected at all.

**GROUP – B****( Short Answer Type Questions )**Answer any *three* questions.

3 × 5 = 15

- What is a microemulsion ? How can you prepare a microemulsion ?
- What are core-shell nanoparticles ? Give a typical UV spectra for Ag-Au core-shell nanoparticle.
- What is an Aerogel ? How can you prepare silica Aerogel ?
- Explain with a schematic diagram the principle of measuring the size of nanoparticles using Atomic Force Microscopy. Name three different modes for operating AFM.

**GROUP – C****( Long Answer Type Questions )**Answer any *three* of the following.

3 × 15 = 45

- What do you mean by nanolithography ? Write down the principle of 'dip pen lithography'.
  - Explain with schematic diagram, the various steps involved in photolithography.

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7. What is carbon nanotube ? What are the special properties of this material ? Discuss two important types of carbon nanotube. Write down in brief three important processes for making carbon nanotubes.
8. Explain the term nanoclay. Write down the important properties that are improved when a nanoclay is added to make nanocomposites. Explain the terms 'intercalation and exfoliation'. Discuss three important methods by which clays are appropriately mixed to form nanocomposites.
9.
  - a) Describe a chemical method for synthesizing metal oxide semiconductor, giving a suitable Chemical Reactor setup.
  - b) Discuss the principle of Chemical Vapour Deposition method.
10.
  - a) Explain the term Nanomedicine. Why is it so important now ?
  - b) What do you mean by sol-gel process ? Write down the basic steps in a sol-gel process.

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