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Total Number of Pages : 01

M.Sc.I  
FPYC100210<sup>th</sup> Semester Regular Examination 2018-19

NANO SCIENCE &amp; TECHNOLOGY

BRANCH : M.Sc.I(AP)

Time : 3 Hours

Max Marks : 70

Q.CODE : F060

**Answer Question No.1 which is compulsory and any FIVE from the rest.  
The figures in the right hand margin indicate marks.**

- Q1 Answer the following questions : (2 x 10)**
- Define "Nanotechnology". Describe top-down approach for the preparation of nanomaterials.
  - Show that materials made up of nanoparticles have a relative larger surface area when compared to the same volume of material made up of bigger particles.
  - What do you mean by electronic and structural magic numbers?
  - Describe geometric structures of nanoparticles.
  - How the energy levels of a metal change when the number of atoms of the material is reduced?
  - What is fullerene? Give examples of larger and smaller fullerene.
  - Describe carbon nanotubes. Write some potential applications of carbon nanotubes.
  - Define bulk nanostructured materials with some examples.
  - Discuss different quantum nanostructures according to the dimension of the material.
  - What is quantum dot laser?
- Q2**
- Define density of states. How the electronic structures of nanomaterials differ from their bulk counterpart? (5)
  - What do you mean by quantum size effect? Differentiate occurrence of this effect in semiconductors and metals. (5)
- Q3**
- What do you mean by magnetic clusters and describe superparamagnetism in case of ferro and ferrimagnetic nanoparticles? (5)
  - How does melting temperature of gold nanoparticles vary with particle size? (5)
- Q4**
- Describe the structure of fullerene. Discuss how one can modify its electrical conductivity? (5)
  - Write one method for fabrication of carbon nanotubes. Discuss different structures of carbon nanotubes according to the rolling of graphite sheets. (5)
- Q5**
- What do you mean by domains in ferromagnetic material? Explain with diagram how the domains can change when a DC magnetic field is applied? (5)
  - Discuss in detail nanocarbon ferromagnets and their application as high density magnetic storage devices. (5)
- Q6** Discuss the lithography technique for the preparation of quantum nanostructures. With suitable diagram, show the number of electrons  $N(E)$ , density of states  $D(E)$  against energy for different quantum structures. (10)
- Q7** Discuss the principles of Raman spectroscopy. How Raman spectra are used to study carbon allotropic forms? (10)
- Q8 Write short answer on any TWO : (5 x 2)**
- Coulombic explosion
  - Photoluminescence
  - Giant and Colossal Magnetoresistance