 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **PHYSICS**

FOURTH SEMESTER – **APRIL 2012**

# PH 4958 - NANO SCIENCE

Date : 23-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**PART - A**

**Answer ALL questions: (10x2=20)**

1. Highlight the likely disadvantages of nanotechnology concerning replacement of natural products and patents in agri-food industries in developing countries.
2. Write a note on scientific revolutions and opportunities at nanoscale.
3. State the conditions for achieving weak confinement in a nanocrystal.
4. Give examples for soft ferrites.
5. Write the general equations for hydrolysis and condensation reactions during the Sol-gel processing.
6. Mention the various kinds of plasma assisted CVD techniques.
7. Write the Scherrer’s equation for particle size determination.
8. Mention the main components of an XPS system.
9. Give the block diagram of a coupler.
10. Briefly explain the fabrication of a photonic crystal fiber.

**PART - B**

**Answer any FOUR questions: (4x7.5 = 30)**

1. Discuss the energy related application areas of nanotechnology.
2. Outline the formation of family of carbon structures at the nanoscale.
3. Discuss the bottom-up and top-down approaches for preparing nanomaterials.
4. Using block diagram, explain the working principle of a SEM.
5. Explain the fabrication of a nanocrystalline semiconductor LED.

**PART - C**

**Answer any FOUR questions: (4x12.5 =50)**

1. With the help of energy level diagram for an electron confined to a 1D potential well, explain electronic band structure of nanocrystals.
2. Highlight the importance of metaloxide nanocomposites. Explain how the surface sensitization can be achieved with reference to TiO2.
3. Discuss the experimental procedures for synthesizing nanoparticles employing (i) Sona chemical (ii) Photo chemical and (iii) LB techniques.
4. Draw the circuit diagrams and explain the step wise experimental procedures to measure the short circuit current (Isc), open circuit voltage (Voc) and the Fill factor of a solar cell.
5. Describe various types of nano sensors on the basis of optical properties, quantum size effect, electro chemical and biological properties.