



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

FOURTH SEMESTER – APRIL 2015

PH 4958 - NANO SCIENCE

Date : 22/04/2015

Dept. No.

Max. : 100 Marks

Time : 09:00-12:00

Answer all the questions

Section-A

2 X 10 = 20

1. Give examples to demonstrate the interplay between nature and nano.
2. Outline the contributions of Richard Adolf Zsigmondy during the early stages of nanotechnology development.
3. Explain the role of surface sensitization of a wide band gap semiconductor with suitable example.
4. Draw the diagrams to distinguish type I and type II core-shell nanostructures.
5. Write a note on top-down approach for nanoparticle synthesis.
6. Explain the working principle of the electrochemical sensors.
7. What are photonic crystals?
8. Mention the application areas of STM.
9. List the essential components of a XPS.
10. How are the nanoparticles prepared by thermal evaporation method?

Answer any four questions

Section-B

4 X 7.5 = 30

11. Explain the applications of nanotechnology in (a) Agriculture (b) energy (c) aerospace and (d) food packaging.
12. Discuss the structure of quantum well and quantum dots.
13. Discuss the role of QDs in imaging of cancer cells and drug delivering system.
14. With the block diagram, discuss the working of an Atomic Force Microscope.
15. With neat diagram explain the working principle of a SEM.
16. Explain the fundamentals of sol-gel method of nanostructure synthesis.

Answer any four questions

Section-C

4 X 12.5 = 50

17. Discuss the electronic band structure of nanocrystals and solids using “particle in a box” model and energy band diagram.
18. What are excitons? Explain the quantum confinement with HOMO-LUMO model and hence obtain the expressions for the shift in energy corresponding to weak, strong and moderate confinements.
19. Discuss the essential principle and operation of a TEM with a neat block diagram.
20. Draw the equivalent circuit of a ‘real’ solar cell and explain the procedure to determine various parameters involved in a solar cell.
21. Discuss the essential features of UV-Visible and photoluminescence spectroscopic techniques employed for analyzing the nanomaterials.
22. Outline the importance of surface modifications via ion implantation. Describe the experimental procedure to prepare nanocrystals with ion implantation instrument and support it with a few examples.
