

238404

May, 2019

M.Sc. IV SEMESTER

Nano Science & Technology (PHL 403-A)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Why is carbon unique among all other elements?
CO1 (1.5)
- (b) What are the differences between CNT and BN Nanotubes?
CO1 (1.5)
- (c) What are the applications of Buckminsterfullerene?
CO1 (1.5)
- (d) 'Bottom-up technique is more convenient for nano fabrication'. Explain.
CO2 (1.5)
- (e) State the merit and demerits of solution based nano-fabrication techniques.
CO2 (1.5)

- (f) Explain the steps in Sol Gel process to develop the nanomaterials. CO2 (1.5)
- (g) Draw various interaction processes inside a sample during the TEM. CO3 (1.5)
- (h) What is the difference between magnification and resolution? CO3 (1.5)
- (i) Explain use of scanning tunneling microscopy. CO3 (1.5)
- (j) What are importance of Raman Spectroscopy? CO3 (1.5)

PART-B

2. (a) Define density of states in two dimensions and also derive an expression on it. CO1 (10)
- (b) Explain the structure of carbon nanotubes. What are the various types of CNTs on the basis of structure? CO1 (5)
3. (a) What is the tunneling effect when incoming particle has energy less than step potential ($E < V_0$)? CO2 (10)
- (b) Discuss the confinement of carriers in one dimension. CO2 (5)
4. Explain the process to develop an ordered crystalline growth of materials on crystalline substrate? What are its applications? CO3 (15)

5. (a) Explain the basic principle of e-beam evaporation process. CO3 (10)
- (b) Explain the liquid based deposition method for nanofabrication. CO3 (5)
6. (a) Give schematic diagram of SEM and discuss its working. What is most common or standard detection mode? CO4 (10)
- (b) Why UV-Visible spectroscopy is important for optical characterization? CO4 (5)
7. What is Atomic Force Microscope (AFM)? What are the various modes of operation of an AFM? Why a low value of spring constant of cantilever is desirable? CO4 (15)