

Seat No.:

No. Of Printed Pages: 03

[94/A-24]

SARDAR PATEL UNIVERSITY

M.Sc. (Physics)(IIIrd Semester) Examination

Date : 24/10/2016, Day : Monday, Time : 2:00 p.m. to 5:00 p.m.

Subject : Nanoscience and Thin film Physics, Paper No. PS03CPHY02

CBCS(choice based credit system)

Important Note : Q.1 : Multiple choice questions (MCQ) carries one mark each.

Q.2 : Short questions carries two marks each (attempt any seven out of nine)

Q.3 to Q.6 : Long questions carries 12 marks .

Total Marks : 70

Choose any one appropriate option from the following in Q.1

Q.1

(8)

- i) Which of the following plays an important role in the formation of single wall carbon nanotube from graphite
(a) stabilizing agent (b) hydrogen (c) catalyst (d) photoresist
- ii) For nanosensors based on quantum size effect which type of nanoparticles are preferred
(a) magnetic (b) semiconducting metal oxide (c) insulating (d) metallic
- iii) For making features of smaller size of less than 10nm in lithography which radiation will be used
(a) visible (b)ultraviolet (c) lasers (d) high energy ion beams
- iv) In small cluster model the use of potential energies instead of free energies implies the hidden presence of
(a) entropy (b) enthalpy (c) pressure (d) temperature
- v) Which of the following thin film preparation technique utilizes RF energy
(a) flash evaporation (b) e-beam (c) PECVD (d) LECVD
- vi) If the film and substrate are of different material it is termed as
(a) homoepitaxy (b) heteroepitaxy (c) coalescence (d) pseudohomoepitaxy
- vii) In case of KLL transition in AES, the Auger electron is ejected from
(a) K- shell (b) L₁- shell (c) L_{2,3}- shell (d) M-shell
- viii) Which of the following is not an advantage of thin film solar cells?
(a) Low cost (b) Flexible structure (c) High efficiency (d) None

Q.2

Answer any seven questions out of nine in Q.2

(14)

- i) What are metal colloids ? State the ways by which metal colloids can be stabilized.
- ii) State the principles on which particle size analyzer and Raman spectroscopy works.
- iii) Define the terms adsorption, desorption and thermal accommodation.
- iv) Explain how bond energy for the small cluster model is evaluated by Lewis for one, two, three and four atom cluster.
- v) Explain in short the two processes of LECVD technique?
- vi) Why metal coating is necessary on fibre aperture in SNOM and which type of material is used for making AFM tips in modern instruments?
- vii) Mention different generations of solar cells and point out merits of thin film solar cell.
- viii) Justify the use of RF for deposition of thin films of insulating material by RF magnetron sputtering technique.
- ix) What are MEMS and NEMS? Write their potential applications.

Q.3(a) Describe construction and working of quantum dot infrared laser. (6)

Q.3(b) Discuss Ball milling technique used for synthesis of nanostructures. Also explain the basic principle and working of scanning tunneling microscope. (6)

OR

Q.3(b) By drawing the lay out diagram of an experimental technique in which electron beam transmits through the specimen describe its construction and working . (6)

Q.4(a) Obtain the expression for critical nucleus and nucleation rate in capillarity model. (6)

Q.4(b) Discuss the techniques in which diamond needle and quartz crystal is used to determine the thickness of thin films ? (6)

OR

Q.4(b) What do the terms nucleation, island formation, coalescence, channel and hole formation means ? Describe them upto the stage of continuous film formation reaches with necessary diagrams. (6)

Q.5(a) What are ion beam assisted deposition methods? Discuss any one in detail. (6)
Mention advantages and limitations of these techniques. Is epitaxial growth of thin films possible using this technique?

Q.5(b) Describe the epitaxial growth of thin films and enlist different methods practiced for it. Explain any one epitaxial thin film preparation technique in detail. (6)

OR

Q.5(b) Distinguish between PVD and CVD process of thin film deposition and describe e-beam evaporation technique in detail. State its applications, advantages and limitations. (6)

Q.6(a) Discuss in detail working principle and operation of RBS. Justify the use of light and high energy ion beam for compositional identification of thin film sample. (6)

Q.6(b) Describe the chemical compositional characterization technique that has highest sensitivity for identification of doping levels in semiconductor devices. (6)

OR

Q.6(b) Describe the origin and causes of various signals emerging out by interaction of high energy electron-beam with a solid surface. Discuss the construction and working of SEM. (6)

: Page No. 3 :

***** THE END *****

No. of printed pages [3]

