[A-105]

SARDAR PATEL UNIVERSITY
M.Sc. (Physics)(IIIrd Semester) Examination
Date : 23/04/2015, Day : Thursday, Time : 2:30 p.m. to 5:30 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 the appropriate options from the following in Q.1

(8)

Q.1

i) Which of the following methods of thin preparation is used to prepare insulating thin films
(a) DC sputtering (b) thermal evaporation (c) RF Magnetron sputtering
(d) none of these

ii) The confinement (D is for dimension) of electrons in carbon nanotubes is in
(a)1D   (b) 2D   (c) 3D   (d) 0D

iii) Which of the following process is involved in the vapor phase epitaxy?
(a)chemical vapor deposition   (b) diffusion   (c) ion implantation
(d) physical vapor Deposition

iv) In capillarity model, to form condensed phase i.e stable aggregates from the supersaturated vapour we require supersaturation
(a) less than unity   (b) zero   (c) greater than unity   (d) infinite

v) STM tip is made up of which type of material
(a) iron-nickel   (b) platinum-iridium
(c) nickel -chromium   (d) nickel-cobalt

vi) Which of the following technique can be used to determine the thickness of thin films in-situ
(a) QCTM   (b) Stylus profilometry   (c) FECO   (d) FET

vii) In which of the chemical characterization techniques for thin films, the three electron energy states are involved to produce the signature of element under observation?
(a)RBS   (b) AES   (c) XPS   (d) SEM

viii) The most suitable material for MEMS is
(a) GaAs   (b) Ge   (c) Si   (d) diamond

Q.2 **(14)**

    i) What is AFM ? What information you can get with the help of it and also mention different modes of AFM.

    ii) State the basic principle of Raman spectroscopy.

    iii) State merits and limitations of e-beam evaporation technique.

    iv) Define the terms adsorption, desorption and thermal accommodation.

    v) How XRD from thin films is obtained ? Explain.

    vi) Differentiate between capillarity and atomistic model.

    vii) Write advantages of thin film solar cells over crystalline solar cells

    viii) State Stoke-Einstein's relationship used to determine the particle size. What are the limitations of determining particle size using this expression.

    ix) What is epitaxial growth of thin films? Explain and mention different methods used for it.

Q.3(a) Using schematic diagrams explain how quantum dot lasers can be fabricated. **(6)**

Q.3(b) Describe the techniques known to you for synthesizing carbon nanotubes at laboratory scale. **(6)**

OR

Q.3(b) Explain the basic principle, construction and working of scanning tunneling microscope. **(6)**

Q.4(a) Explain capillarity model and obtain the expression for critical nucleus and nucleation rate. **(6)**

Q.4(b) Discuss four stages of thin film growth. **(6)**

OR

Q.4(b) What is lithography ? Explain different steps involved to form quantum dots using photolithography **(6)**

Q.5(a) Explain PECVD technique used for depositing thin films. **(6)**

Q.5(b) Why Radiofrequency technique is preferred over DC sputtering for depositing dielectric films ?. Explain RF sputtering in detail. **(6)**

OR

Q.5(b) What is meant by epitaxy ? Discuss molecular beam epitaxy technique to form a monolayer film. **(6)**

Q.6(a) Describe the construction and working of scanning electron microscope(SEM). **(6)**

Q.6(b) What are NEMS and MEMS? What is System on Chip-SOC? Justify the use of Si for these devices. **(6)**

OR

Q.6(b) Explain Rutherford back scattering technique in detail. **(6)**

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