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SEAT No. \_\_\_\_\_

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SARDAR PATEL UNIVERSITY

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

Date :22/03/2019, Day : Friday, Time :10:00a.m. to 1:00 p.m.

Subject : Nanoscience and Thin film Physics, Paper No. PS03CPHY22

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

Q.1 Choose the appropriate options from the following in Q.1 (8)

- 1 Which microscope is useful for conducting samples ?  
(a) STM (b) AFM (c) SNOM (d) all of these
- 2 Quantum dot is an example of which type of nanostructure  
(a) 3D (b) 1D (c) 2D (d) 0D
- 3 Which spectroscopy technique involves acoustic phonons ?  
(a) Raman (b) UV-VIS (c) IR (d) Brillouin
- 4 For sustaining glow discharge in R.F. sputtering the frequency range must be in  
(a) Hertz (b) Kilohertz (c) Megahertz (d) none of these
- 5 For observation of the discrete nature of single electron charge transfer to a quantum dot which condition is to be satisfied.  
(a)  $e^2/2C > kT$  (b)  $e^2/2C < kT$  (c)  $e^2/2C = kT$  (d)  $e^2/2C = 0$
- 6 If the emitted vapour stream will have the same velocity distribution in all directions then such type of source is termed as  
(a) Surface (b) Point (c) Point and surface (d) Cylindrical
- 7 Which technique measures and interprets the change of polarization state to determine the thickness of thin films ?  
(a) FET (b) Stylus-Profilometry (c) VAMFO (d) Ellipsometry
- 8 In ionized cluster beam deposition method for cluster formation the nozzle diameter must be ----- the mean free path of vapour atoms in the crucible.  
(a) large (b) small (c) equal (d) none of these

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(P.T.O.)

(1)

- Q.2 Answer any seven questions out of nine in Q.2 (14)**
- 1 Explain what do you understand from quantum confinement and surface effects of nanomaterials.
  - 2 How constant height and constant current mode differs in STM?
  - 3 What is the advantage of HRTEM of conventional TEM ?
  - 4 What is meant by pyrolysis ? Write the reaction by which silicon dioxide can be deposited.
  - 5 Write the basic principle of optical method used for thickness measurement. Abbreviate FET and FECO.
  - 6 Define sputtering and sputtering yield.
  - 7 State how nanomaterials can be useful for automobiles and tougher and harder cutting tools.
  - 8 What are excitons ? Differentiate between two types of excitons known to you.
  - 9 What is Raoult's law ?
- Q.3(a) Describe arc discharge and laser ablation method used for synthesis of nanoparticles. (6)
- Q.3(b) Explain preparation of quantum nanostructures by photolithography technique. (6)
- OR**
- Q.3(b) Discuss synthesis of nanoparticles by ball milling and sol-gel method . (6)
- Q.4(a) Explain IR detectors by considering infrared transitions involving energy levels of quantum wells. (6)
- Q.4(b) State the working and construction of scanning near field microscopy(SNOM). (6)
- OR**
- Q.4(b) Differentiate between Raman spectroscopy and Brillouin spectroscopy. Explain Raman spectroscopy technique with suitable diagrams for studying nanomaterials. (6)
- Q.5(a) How one can do flash evaporation and electron beam evaporation of compounds, alloys and oxide of metals ? Explain it in detail. (6)
- Q.5(b) Discuss elementary consideration of the kinetic theory of gases and emission condition. (6)
- OR**
- Q.5(b) Explain glow discharge sputtering technique by considering the behaviour of gases at reduced pressures under a high dc voltage source. (6)
- Q.6(a) How thin films are deposited by chemical vapour deposition? Explain compound formation , disproportionation and reversible transfer reaction processes. (6)
- Q.6(b) Describe Ion plating and reactive evaporation processes used for deposition of thin films. (6)
- OR**
- Q.6(b) Discuss Stylus profilometry and quartz crystal oscillator for film thickness measurement. (6)