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SARDAR PATEL UNIVERSITY

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

Date : 12/04/2018, Day : Thursday , Time : 10:00am to 1:00pm

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

Q.1

(8)

- i) In stylus profilometry method, which needle from the following of radius $10 \mu\text{m}$ serves as the electromagnetic pick up ?
(a) diamond (b) graphite (c) quartz (d) silicon
- ii) What changes during and after coalescence of composite island ?
(a) area (b) inclination angle (c) thickness (d) mass
- iii) For depositing insulating films which technique you will prefer
(a) MBE (b) evaporation (c) DC sputtering (d) PECVD
- iv) Which CVD technique is good for depositing epitaxial thin film.
(a) LPCVD (b) LECVD (c) PECVD (d) HTVCD
- v) From the following which technique is used for formation of carbon nanotubes
(a) Ball milling (b) sol-gel (c) co-precipitation (d) laser ablation
- vi) In infrared detectors, the responsivity of the detector is measured in terms of which of the below quantity generated per watt of incoming radiation.
(a) electric current (b) temperature (c) voltage (d) pressure
- vii) Which of the following element cannot be detected with the help of XPS technique
(a) Bi (b) Cd (c) Cu (d) He
- viii) The typical ion energy used in RBS is
(a) 2 keV (b) 2 MeV (c) 2 GeV (d) 2 eV

Q.2

Answer any seven questions out of nine in Q.2

(14)

- i) Which two modes are used in TEM for obtaining an image ? Write in two lines how these two modes work.
- ii) State the basic principle of Raman Spectroscopy.
- iii) What is sputtering? How magnetic field is used to enhance the sputtering yield? Is there any other way to do so? Explain.
- iv) Define the terms adsorption, desorption and thermal accommodation.
- v) How one can obtain a better XRD pattern of ultra thin film ?
- vi) Differentiate between capillarity and atomistic model.
- vii) What is LEED and RHEED ? Which of them is used for insitu thin film characterization.
- viii) Explain photolytic and pyrolytic process of LECVD technique.
- ix) How secondary ion mass spectrometry works ?

Q.3(a) Describe principle, construction and working of atomic force microscope with proper diagrams. (6)

Q.3(b) Discuss sol-gel method and laser ablation technique by which nanostructures can be formed at the laboratory scale. (6)

OR

Q.3(b) By drawing the lay out diagram explain how scanning tunneling microscope can be used to observe the surface details at atomic scale. (6)

Q.4(a) Discuss nucleation, island, channel and continuous film growth stages involved in the growth of thin films. (6)

Q.4(b) Explain QCTM and stylus profilometry methods by which thickness of thin films can be determined. (6)

OR

Q.4(b) What is lithography ? Discuss photo, X-ray and e-beam lithography with their limitations. (6)

Q.5(a) What is epitaxy ? State different epitaxy techniques known to you for depositing films and describe the one which is having lowest deposition rate. (6)

Q.5(b) How ionized cluster beam deposition technique is used for depositing thin films ? State its applications and merits. (6)

OR

Q.5(b) Explain PECVD and MOCVD techniques in detail. (6)

Q.6(a) Discuss Rutherford back scattering technique with its basic principle. (6)

Q.6(b) Describe the construction and working of scanning electron microscope. (6)

OR

Q.6(b) How Auger electron spectroscopy can be used to evaluate chemical make up of the constituents of thin film specimen under observation. (6)

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