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SEAT No. _____

No. of Printed Pages : 3

SARDAR PATEL UNIVERSITY

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

Date : 24/10/2018, Day : Wednesday, 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 the appropriate options from the following in Q.1

Q.1

(8)

- i) For formation of oxide nanoparticles which of the following technique is best suited ?
(a) Laser evaporation (b) CVD (c) Sol-gel method (d) Thermolysis
- ii) In which technique, the three electron energy states are involved to produce the signature of element under observation?
(a)RBS (b) AES (c) XPS (d) SEM
- iii) If deposited film and substrate are of different material it is termed as
(a) homoepitaxy (b)heteroepitaxy (c) heterohomoepitaxy
(d) pseudoheteroepitaxy
- iv) The use of potential energies instead of free energies in the small cluster model implies the hidden presence of which term
(a) partition function (b) entropy (c) temperature (d) pressure
- v) In Quartz crystal thickness monitor which parameter is used to determine the thickness of thin films
(a) frequency (b) wavelength (c) velocity (d)deposition rate
- vi) AFM tips and cantilever assembly are made from which material
(a) SiN (b) GaAs (c) InSb (d) Ge
- vii) MgK_{α} radiation is used in which technique
(a)X-ray diffraction (b) XPS (c) SIMS (d) AES
- viii) Pyrolytic and Photolytic process are related to which method
(a)PECVD (b) HTCVD (c) MOCVD (d) LECVD

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Q.2

Answer any seven questions out of nine in Q.2

(14)

- i) How Auger electron are produced and explain how one can do depth profiling studies with AES ?
- ii) In which form sample is required for TEM ? State the two different modes of TEM and explain them in short.
- iii) Discuss how MOCVD reaction can be used to deposit semiconductor epitaxial film using chemical equation.
- iv) Differentiate between evaporation and sputtering techniques.
- v) Explain in short how RHEED and LEED differs from each other.
- vi) Derive the expression for critical size nuclei in the case of capillarity model.
- vii) Mention the two conditions required for single electron tunneling ?
- viii) What is lithography ? Why it has gained popularity since last few decades ?
- ix) Explain what is meant by thermal accommodation coefficient.

Q.3(a) Using schematic diagrams explain the working principle of Atomic force microscope. (6)

Q.3(b) Describe different techniques by which carbon nanotubes can be synthesized. (6)

OR

Q.3(b) By drawing the lay out diagram describe construction and working of Scanning tunneling microscope. (6)

Q.4(a) State different stages involved in the growth of thin films and explain each of them in detail with suitable diagram. (6)

Q.4(b) With the help of the relevant expressions explain atomistic theory in detail. (6)

OR

Q.4(b) Explain techniques known to you for measurement of thickness of thin films. (6)

(2)

Q.5(a) Why RF sputtering is suitable for depositing insulating films ? Explain this technique in detail. (6)

Q.5(b) State the advantage of molecular beam epitaxy over liquid phase epitaxy technique. Discuss in detail MBE method for depositing monolayer films. (6)

OR

Q.5(b) Explain ion plating technique with suitable diagram used for depositing thin films. (6)

Q.6(a) Describe in detail SEM technique used for studying surface morphology of the sample. (6)

Q.6(b) How Rutherford back scattering(RBS) is useful in analyzing thin film samples ? Explain it in detail. (6)

OR

Q.6(b) Discuss how X-ray photoelectron spectroscopy (XPS) is helpful in elemental identification. (6)

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