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

No. of Printed Pages : 2

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. 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

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

- 1 For targeted drug delivery which of following nanoparticles are preferred  
(a) tungsten nanowires (b) carbon nanotubes (c) insulating (d) magnetic
- 2 Three electron energy states are involved to produce the signature of element under observation in which method  
(a)RBS (b) AES (c) XPS (d) SEM
- 3 Which of the following thin film preparation technique utilizes RF energy ?  
(a) flash evaporation (b) e-beam (c) PECVD (d) LECVD
- 4 Lithography using ----- do not require mask to generate pattern ?  
(a) photons (b) lasers (c) electron (d) X-rays
- 5 In coalescence phenomena, when two islands merge together which of the following term decreases  
(a) area (b) mass (c) length (d) breadth
- 6 AFM tips and cantilever assembly are made from which material  
(a) SiN (b) GaAs (c) InSb (d) Ge
- 7 For characterizing thin films by X-ray diffraction, how the film should appear to the beam ?  
(a) thin (b) thicker (c) ultrathin (d) None of these
- 8 In QCTM technique which parameter is used to determine the thickness of the film?  
(a)velocity (b) frequency (c)stress (d) force

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(P.T.O.)

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- Q.2 Answer any seven questions out of nine in Q.2 (14)**
- 1 What is the basic principle on which AFM works and which type of tip is used in AFM ?
  - 2 State and write the expression used for particle size determination in particle size analyzer.
  - 3 Which two conditions must be satisfied to get single electron tunneling ?
  - 4 Define the terms adsorption, desorption and thermal accommodation.
  - 5 Why molecular beam epitaxy is preferred over liquid phase epitaxy ?
  - 6 Explain how bond energy for the small cluster model is evaluated by Lewis for one, two, three and four atom cluster.
  - 7 Justify the use of RF sputtering for deposition of thin films of insulating material.
  - 8 What information does XPS technique gives about the sample ?
  - 9 What are NEMS and MEMS?

- Q.3(a) Explain principle, working and construction of transmission electron microscope. (6)**  
**Q.3(b) Describe how one can synthesize oxide nanoparticles at laboratory scale. (6)**

**OR**

- Q.3(b) By drawing the lay out diagram describe construction and working of Scanning near field optical microscope(SNOM). (6)**

- Q.4(a) Discuss four different stages of film growth with suitable diagram. (6)**  
**Q.4(b) Explain capillarity theory for understanding the growth of thin films. (6)**

**OR**

- Q.4(b) What is lithography ? Explain why X-ray and electron beam lithography are better than photolithography. (6)**

- Q.5(a) Explain in detail PECVD and LECVD techniques for depositing thin films ? (6)**  
**Q.5(b) Discuss in detail MBE method used for depositing monolayer films. (6)**

**OR**

- Q.5(b) Explain with suitable diagram magnetron sputtering used for depositing thin films. (6)**

- Q.6(a) Describe in detail XRD technique used for studying structure of the sample. (6)**  
**Q.6(b) How RHEED differs from LEED ? Explain LEED with proper diagrams. (6)**

**OR**

- Q.6(b) Explain in detail how SIMS is helpful in studying thin films? Differentiate between static and dynamic SIMS. (6)**

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