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SEAT NO. _____

No. of Printed Pages : 2

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. 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 Objective lens in TEM produces the image of the object ?
(a) Second (b) third (c) first (d) fourth
- 2 Thin films is an example of which type of nanostructure
(a) 3D (b) 1D (c) 2D (d) 0D
- 3 For III-V and II-VI semiconductors the temperature coefficient (dE_g/dT) of the energy gap is negative which means that the absorption undergoes
(a) red shift (b) blue shift (c) green shift (d) yellow shift
- 4 Who derived theoretical model for sputtering phenomena ?
(a)Raoult (b) Clausius-Clapeyron (c) Sigmund (d) Hertz
- 5 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
- 6 _____ Source does not depend on the angle between vapor direction and normal vapor source surface.
(a)Surface (b) Point (c) Point and surface (d) Cylindrical
- 7 Which of the following optical method is used to measure the thickness of Opaque film
(a)FET (b) Stylus-Profilometry (c) VAMFO (d) Ellipsometry
- 8 _____ gas is used for reactive evaporation and reactive sputtering techniques for thin film deposition.
(a) Oxygen (b) Nitrogen (c)Methane (d) All of these

P.T.O.

(1)

- Q.2 Answer any seven questions out of nine in Q.2 (14)**
- 1 For a conducting sample which microscope is useful to study its surface at atomic level. Differentiate between its different modes.
 - 2 How dark field image and bright field image is obtained in TEM?
 - 3 Describe in short dip pen lithography technique.
 - 4 Obtain vapors pressure of the elements using Clausius -Clapeyron equation.
 - 5 Why Ion plating method is known as hybrid method ? Explain Ion plating method in brief.
 - 6 Explain Ion-surface interaction.
 - 7 State how nanomaterials can be useful for high definition TV and flat-panel displays.
 - 8 How Brillouin spectroscopy differs from Raman Spectroscopy.
 - 9 List out the mechanical techniques for film thickness measurement. Explain Crystal Oscillator method in brief.
- Q.3(a) Describe Reverse micelles and sol-gel method used for synthesis of nanoparticles. (6)
- Q.3(b) Explain how quantum dots can be formed using photolithography technique. (6)
- OR**
- Q.3(b) Discuss dynamic light scattering(DLS) method used for estimating the size of nanoparticles. (6)
- Q.4(a) For the passage of electrons one by one through FET-type nanostructure, explain how single electron tunneling takes place in this type of device. (6)
- Q.4(b) Explain Raman spectroscopy with suitable diagrams for studying nanomaterials. (6)
- OR**
- Q.4(b) By taking suitable examples, explain how infrared surface spectroscopy can be helpful to study nanomaterials. (6)
- Q.5(a) Define evaporation Rate. What is the difference between evaporation of compound and alloys? Explain Raoult's law for evaporation of alloys and its limitations. (6)
- Q.5(b) Discuss in detail electron beam method with different types of electron beam guns. (6)
- OR**
- Q.5(b) Define sputtering and sputtering yield? Discuss various sputtering regimes : (a) Single knock on (b) Linear collision cascade (6)
- Q.6(a) Write a detail note on chemical vapour deposition and different reactions involved. (6)
- Q.6(b) Describe Ionized cluster beam deposition method. Write down advantages and disadvantage of this method. (6)
- OR**
- Q.6(b) Write the working principle of optical method for film thickness measurement and describe optical thickness measurements method for transparent film. (6)

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