

B.TECH
(SEM IV) THEORY EXAMINATION 2017-18
NANO SCIENCE

Time: 3 Hours

Total Marks: 70

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** **2 x 7 = 14**
- a. What do you understand by Nano science? Write down its technological importance.
 - b. Write the expression for effective mass. Describe the utility of reciprocal space.
 - c. Define quantum well, quantum dot and quantum wire.
 - d. Explain Fermi gas and write the expression for Fermi energy.
 - e. What is the difference between lithographic and non-lithographic techniques of device fabrications?
 - f. What is scanning probe microscopy (SPM)?
 - g. Describe single electron transistor.

SECTION B

2. **Attempt any *three* of the following:** **7 x 3 = 21**
- a. Explain the quantum confinement; derive the expression for energy in one-dimensional quantum well.
 - b. What is the basis for solid materials to be classified in to conductors, semiconductors and insulators? Explain in brief band theory of solids.
 - c. Derive the expression for effective mass and explain how its values change from conductors to semiconductors.
 - d. What do you understand by RF plasma? Explain in detail the RF sputtering technique of thin film deposition.
 - e. Explain the importance of X ray diffraction (XRD) study in Nano science. What important parameters can be obtained by XRD analysis, explain them in brief.

SECTION C

3. **Attempt any *one* part of the following:** **7 x 1 = 7**
- (a) What do you understand by localized particles? Explain the terms deep traps; mobility and excitons related to the localized particles.
 - (b) What is the importance of theoretical modeling in magnetic nano particles? Write down the important applications of magnetic nano particles.
4. **Attempt any *one* part of the following:** **7 x 1 = 7**
- (a) What are the main components of chemical vapor deposition technique? Write down its importance in growth of 2D structures.
 - (b) Explain the construction and working of e beam evaporation technique for thin films deposition.

5. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Explain the term epitaxy. What is its importance in the study of nano semiconducting systems explain.
- (b) For what type of substances pulsed laser deposition (PLD) technique is best suited. Explain working of PLD system briefly.

6. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Draw the neat schematic diagram of scanning electron microscope (SEM). Elaborate its importance in nano science.
- (b) What do you understand by atomic force microscopy (AFM)? Explain its importance in study of nano structures.

7. Attempt any *one* part of the following:

7 x 1 = 7

- (a) How are the carbon nano tubes (CNT) fabricated by CVD explain? What are their major applications?
- (b) What is the importance of 2D material boron nitride? How are the boron nitride nano tubes formed.

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