Register Number: …………….

B.E., DEGREE EXAMINATIONS: MAY/JUNE 2013

Eighth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE146: Nano Technology

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. To be classed as nanoscale, an object must have one dimension that is of the order of

    a. 10^{-10}m   b. 10^{-12}m   c. 10^{-9}m   d. 10^{-15}m

2. Nanotubes usually form in bundles. Which is the best description of a bundle?

    a. The tubes are connected together by C-C bonds

    b. The tubes are randomly organized with the tube axes in random directions

    c. The tubes are aligned, axes parallel, with the Vanderwaal's forces operating

      between adjacent tubes

    d. The bundles are of discrete sizes and dipole forces hold the tubes together.

3. Graphene is a

    a. wide band gap semiconductor

    b. gaples band semiconductor

    c. not a semiconductor but behaves like a graphite

    d. narrow band gap semiconductor

4. The width of carbon nanotube is

    a. 1 nm   b. 1.3 nm   c. 1.55 nm   d. 10 nm

5. Which has the highest thermal conductivity?

    a. carbon nanotubes   b. diamond   c. Gold   d. Copper

6. What is a bucky ball?

    a. a carbon molecule (C60)

    b. nickname for Mercedes Benz's fabric concept car (C111)

    c. plastic explosive nanoparticle (C4)

    d. concrete nanoparticle with a compressive strength of 20 nanoNewtons (C20)

7. The probe of scanning tunneling microscope is as sharp as

   a. an atom at the tip   b. many atoms at the tip

   c. a needle   d. none of the above

8. The most important property of nanomaterials is

   a. Force   b. Friction   c. Pressure   d. Temperature

9. The size of quantum dot is

   a. 5m   b. 5×10^{-9} m   c. 5×10^{-10} m   d. 5×10^{-11} m

10. Nanoparticles are

   a. transparent   b. opaque   c. turbid   d. greasy

PART B (10 x 2 = 20 Marks)

11.   What is pseudo potential?

12.   State the advantages of pair-potential approximation.

13.   Draw the structure of the Carbon cluster C_{4h}.

14.   What are the methods used to make carbon nanotubes?

15.   Define thermolysis.

16.   What is nano lithography?

17.   State the basic properties of nanomaterials.

18.   What is the principle of field ion microscopy?

19.   What is a nano wire?

20.   What are MEMS?

PART C (5 x 14 = 70 Marks)

21.a) (i) Discuss about the quantum mechanical treatment of Many-Particle problem   (7)

    (ii) Write a note on many-body potentials   (7)

(OR)

  b) (i) Discuss in detail about thermodynamic aspects of solid state materials.   (10)

    (ii) State the limitations of pair-potential approximation.   (4)

22.a) (i) What are the methods used to determine the size of particles? Explain in brief. (8)

    (ii) Describe the electronic structure of carbon atom.   (6)

.   **(OR)**

b) (i) Explain about the optical properties, photo fragmentation and Coulombic (8)
explosion of semiconducting nano particles.

(ii) Write a note on the optical properties of carbon nanotubes. (6)

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23. a) (i) Describe the process of nano lithography (7)

(ii) Describe the different methods of nanoparticle synthesis. (7)

(OR)

b) Describe in detail the fabrication, structure and properties of carbon nanotubes

24. a) (i) Describe the principle and operation of Transmission Electron Microscope (10)

(ii) Write a note on photoemission spectroscopy, applicable to characterization of
nano particles. (4)

(OR)

b) Describe the principle and operation of Scanning electron and Scanning
tunneling microscope

25. a) (i) Write the importance and feature of molecular and super molecular switches. (7)

(ii) Write a note on NEMS. (7)

(OR)

b) (i) Explain how carbon nanotubes are applied in field emission and shielding, (7)
computers and fuel cells.

(ii) Discuss the role of nanotechnology in designing micro-electromechanical
systems. (7)

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