CBCS Scheme

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15NT35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Physical & Chemical Principles of Nanotechnology

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Discuss the dual nature and matter and arrive at the various forms of de Broglie wavelength expression. **(05 Marks)**

b. Evaluate the de Broglie wavelength of Helium nucleous ($_2He^4$) that is accelerated through 500V. Given mass of nucleous is 1.67×10^{-27}kg. **(03 Marks)**

c. What is molecular orbital theory? Discuss its quantitative approach by taking benzene and methane as a examples. **(08 Marks)**

OR

2 a. Discuss the fundamental and applications of valence bond theory. what are its drawbacks? **(08 Marks)**

b. Write a note on 'Introduction to computation chemistry, the note must cover the definition, ab – initio techniques various mechanics involved such as statistical and molecular mechanics and the role of artificial intelligence with remarkable conclusions. **(08 Marks)**

Module-2

3 a. State and illustrate all the four laws of thermodynamics with relevant expressions, wherever it is applicable. **(10 Marks)**

b. An iron cube at a temperature of 400°C is dropped into an insulated bath containing 10kg water at 25°C. the water finally reaches a temperature of 50°C at steady state. Given that specific heat of water is equal to 4186J/kg K. find the entropy changes for the iron cube and the water. Is the process reversible? **(06 Marks)**

OR

4 a. List the thermodynamic conditions for equilibrium? Define heat capacities at constant volume and constant pressure? **(06 Marks)**

b. State second law of thermodynamics? Discuss the variation of free energy change with temperature and pressure. **(10 Marks)**

Module-3

5 a. Based on the band theory of metals explain how to distinguish metals, insulators and intrinsic semiconductors? **(06 Marks)**

b. Arrive at the representation of Brillion zones of up to third order using kronig-penny model applied to one dimensional periodic potential. **(10 Marks)**

OR

6 a. Write the expression for Debye frequency, Debye temperature and arrive at Debye is T^3 how? List the limitations of Debye's theory of molar heat capacity. **(12 Marks)**

b. Determine the energy as heat needed to increase the temperature of 10mol of mercury (Hg) 7.5K. The value of C for Hg is 27.8 J/k mol. **(04 Marks)**

Module-4

7 a. Define the concept of hole. Derive the expression for intrinsic carrier concentration of an intrinsic semiconductor. **(12 Marks)**

b. The resistivity of Si at 300K is 3.16×10^3 Ωm. Calculate the intrinsic carrier density. Mobility of electrons and holes in Si are 0.14 $m^2 V^{-1} S^{-1}$ and 0.05 $m^2 V^{-1} S^{-1}$. **(04 Marks)**

OR

8 a. What is tunneling? Write the expression for tunneling current and explain the terms in it with proper unit? Further, write a note on tunnel diode along with its I-V characteristics and the applications. **(10 Marks)**

b. GaAs, a direct band gap semiconductor with an energy gap of 1.5eV is irradiated by photons of energy 1.6eV. If the effective mass of electrons and holes in GaAs are 0.07 and 0.068 times the free electron mass respectively, calculate the kinetic energy and moment of the carriers. **(06 Marks)**

Module-5

9 a. What are colloids? Discuss their dynamic optical and electrical properties. **(11 Marks)**

b. List the applications of colloids in various sectors like medical, pharmacentical, industry etc. **(05 Marks)**

OR

10 a. List the types of colloidal dispersions with suitable examples. **(06 Marks)**

b. Explain how the various emulsions can be identified based on their characteristics. List the possible applications of emulsions. **(10 Marks)**

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