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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (Open Elective)

END SEMESTER EXAMINATIONS, 23 June 2017

SUBJECT: PHYSICS OF MATERIALS [PHY 3282]

REVISED CREDIT SYSTEM

Make-up Exam

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Explain the construction and working of Transmission Electron Microscope. How is it different from Scanning Electron Microscope? **[4]**

1B. What are nano-materials? Discuss any two methods of preparation of nano-materials. What are the applications of nano-materials? **[4]**

1C. What is fullerene? Describe the special features of fullerene. **[2]**

2A. What is reinforcement material in the context of composites? What are the important characteristics of high performance reinforcement materials? Discuss the properties of glass and carbon fibers. **[5]**

2B. What are polymers? Classify polymers in terms of curing process and different chain configurations. **[2]**

2C. For a composite material, the mass fractions of matrix and fiber are 60% and 40%. The densities of fiber and matrix are given as 2.6 and 1.5 g/cm^3. Estimate the density of the composite. **[3]**

3A. Consider a composite material with masses of fiber and matrix as m_f and m_m. Let the volumes of fiber, matrix and voids are v_f, v_m and v_v respectively. Derive the expression for the volume of the composite made from the matrix and fiber. The densities of the fiber, matrix and composite are respectively ρ_f, ρ_m and ρ_c. **[4]**

3B. Consider a unidirectional reinforced glass fiber/epoxy composite. The fibers are continuous and 50% by volume. It is given that the specific heat of the fiber and matrix are respectively 0.65 and 0.5 J/K. The density of matrix and fiber are 1.1 and 2.6 g/cm^3 respectively. Estimate the specific heat of the composite. **[3]**

3C. What are polymer matrix composites? Give examples of three important polymer matrices stating their applications. [3]

4A. Derive the expression for contact potential in a semiconductor-semiconductor junction. [4]

4B. Using the concept of Fermi energy, calculate the probability of Fermi energy level to be occupied by an electron. [2]

4C. In two long n- and p-type Si bars each cross sectional area 0.4 cm^2, the mobility of holes (at p-side) and electrons (in n-side) is 480 cm^2/V-s and 1350 cm^2/V-s respectively at 300 K. Calculate the diffusion coefficient and diffusion length. It is given that the carrier life time of electrons and holes are respectively 10^{-10} sec 10^{-9} sec. [4]

5A. Discuss any two methods of crystal growth. [4]

5B. Consider a semiconductor with an energy gap of 0.67eV. Compute the number of conduction electrons at 300 *K* and 350 *K*. [3]

5C. What are quantum dots? Discuss any one method of preparation of quantum dots. [3]