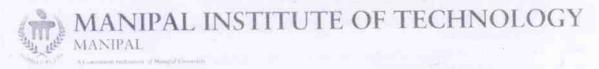
Porgonal by St. Flohok Rao

Reg. No.



## IV SEMESTER B.TECH. (Open Elective)

## END SEMESTER EXAMINATIONS, April/May 2017

SUBJECT: PHYSICS OF MATERIALS [PHY 3282]

## REVISED CREDIT SYSTEM

(02/05/2017)

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 Scanning Electron Microscope. Distinguish between top down and bottom up approaches of preparing [4] nanomaterials. 1B. Classify magnetic materials in terms of dimensions. What are quantum dots? Describe the method of production of quantum dots. Discuss the size effect on optical properties of quantum dots. Give any two applications of quantum [4] dots 1C. What are carbon nano-tubes? Discuss its any two mechanical properties. [2] 2A. What are composite materials? Give examples of composite materials. Compare the properties like weight, thermal expansion, stiffness and strength [3] of typical composite materials with steel and aluminum. 2B. Consider a uni-directional composite material. Derive the rule of mixtures for Young's modulus when a force is applied in (i) fiber direction and (ii) [4] transverse direction. 2C. Consider a composite consisting of spherical particles dispersed in a matrix with 50% volume fraction of fiber. It is given that the volumetric expansion of the matrix and fiber are respectively 16x 10<sup>-6</sup> and 7x 10<sup>-6</sup> per degree Celsius. The bulk moduli of the fiber, and matrix are respectively 100 GPa, 5 GPa and the shear modulus of the matrix is 50 GPa. Estimate the volumetric expansion of the composite. [3] 3A. Consider a fiber of length, L embedded in a matrix subjected to a strain. [4] Derive the expression for shear stress along the matrix interface. 3B. A unidirectional fiber composite with axial stress of the fiber and matrix of 100MPa and 20 MPa respectively has 40% volume fraction of fiber. Given that the matrix stress at the strain corresponding to the fiber ultimate tensile strength is 15MPa, calculate the minimum and critical volume fractions. [3]

3C.	montant metal	121
4A.	matrices stating their applications.  Derive the expression for density of charge carriers in intrinsic semiconductors.	[3]
4B.		[3]
4C.	In a Si based p-n junction with area of cross section of 10 <sup>-4</sup> cm <sup>2</sup> and intrinsic	
	carrier density of 1.5x 10 <sup>10</sup> /cm <sup>3</sup> , the following parameters are given:	
	At p-side: N <sub>a</sub> =10 <sup>17</sup> cm <sup>-3</sup> carrier life time =0.1µs, mobility of electrons	
	and holes are 700 and 200 cm <sup>2</sup> /V-s.	
	At n-side: N <sub>d</sub> =10 <sup>15</sup> cm <sup>-3</sup> , carrier life time =10 µs, mobility of electrons	
	and holes respectively are 1300 and 450 cm <sup>2</sup> /V-s.	
	The junction is forward biased by 0.5 V. What is the forward current?	
	Estimate the current at a reverse bias of -0.5 V.	[4]
5A.	Discuss the Bridgeman method and Czochralski method of crystal growth.	[4]
5B.	Which of the following semiconductors are transparent, partially transparent,	1.1
	non-transparent for visible light ( $\lambda = 0.4-0.7 \ \mu m$ ). Si, GaAs, GaP, and GaN?	
	Given that their energy gaps are respectively 1.12, 1.42, 2.26, 3.44 eV.	[3]
5C.	Describe the method of magnetic sorting using nano-magnets	[3]