Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (Open Elective)

END SEMESTER EXAMINATIONS, 26 June 2018

SUBJECT: PHYSICS OF MATERIALS [PHY 3282]

REVISED CREDIT SYSTEM
Makeup Test

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. [3]

1B. Explain how magnetic sorting is done using nano-magnets with necessary diagrams. [3]

1C. Discuss any method of preparing nano-tubes. Describe any two applications of nano-tubes. [4]

2A. What are composite materials? Give examples of composite materials. Compare the properties like weight, thermal expansion, stiffness and strength of typical composite materials with steel and aluminum. [4]

2B. What are metal matrix composites? Describe and four applications of metal matrix composites. [4]

2C. Discuss the effect of moisture and temperature on the mechanical properties of composites. [2]

3A. For a fiber of equivalent diameter 25 μm, the elastic modulus is given as 400 GPa. Calculate the flexibility of the fiber. Also estimate the flexibility if the equivalent diameter is reduced to 10 μm. [4]

3B. Consider a composite material (with 40% fiber volume) which is under two modes of loading namely longitudinal and transverse. If the Young's moduli of the fiber and matrix are 650 GPa and 20 GPa respectively, estimate the Young's modulus of the composite in the two modes. [3]

3C. A composite material contains 30% wt of glass fiber with 10 % volume fraction of void. If the density of matrix and fiber are 1.1 and 2.6 g/cm^3 respectively, what is the density of the composite? [3]

4A. Consider a semiconductor with an energy gap of 0.67eV. Compute the number of conduction electrons at 300 *K* and 350 *K*. [3]

4B. For a p-n junction diode, the hole densities in p-side and n-side are respectively 10^{10} per cm^3 and 10^5 per cm^3. Estimate the contact potential at 300 *K*. [3]

4C. Consider a semiconductor wire under application of an electric field of 10V/m. If the current density through the wire is 1 A/m^2, compute the electrical conductivity of the semiconductor. Suppose the number of charge carriers is $3x\ 10^{21}$ per cm^3, compute the relaxation time, mobility and the drift velocity of the electrons. [4]

5A. Draw the energy level diagram of a pn-junction diode, before as well as after the junction is made. Derive the expression for the contact potential in the forward biased condition. [4]

5B. What is diffusion of charge carriers in the context of semiconductors? Using drift as well as diffusion currents, derive Einstein relation. [4]

5C. Describe any method of crystal growth. [2]