Applied Physics 1 - May 2016

TOTAL MARKS: 60
TOTAL TIME: 2 HOURS

(1) Question 1 is compulsory.
(2) Attempt any **three** from the remaining questions.
(3) Use suitable data wherever required.
(4) Figures to the right indicate full marks.

Attempt any five from the following

1(a) Draw (a) $(1\ \bar{1}\ 2)$ (b) (0 4 0) (c) [0 4 0] with reference to a cubic unit cell (3 marks)

1(b) What is the probability of an electron being promoted to the conduction band in diamond at 27°C, if the bandgap is 5.6 eV wide? (3 marks)

1(c) Define drift current, diffusion current and mobility of charge carriers. (3 marks)

1(d) What is dielectric polarization and dielectric susceptibility? Write the relation between them. (3 marks)

1(e) State and explain Ohm's law in magnetic circuit. (3 marks)

1(f) Write Sabine's formula and explain the terms used in it. (3 marks)

1(g) Calculate the length of an iron rod which can be used to produce ultrasonic waves of 20kHz Given - $Y = 11.6 \times 10^{10} N/m^2$, $\rho = 7.23 \times 10^3\ kg/m^3$ (3 marks)

2(a) Explain formation of energy bands in solids and explain classification on the basis of energy band theory. (8 marks)

2(b) Zn has hcp structure. The nearest neighbour distance is 0.27 nm. The atomic weight of Zn is 65.37. Calculate the volume of unit cell, density and atomic packing fraction of Zn. (7 marks)

3(a) What is hysteresis? Draw a hyteresis for ferromagnetic material and explain various important parameters. (8 marks)
A magnetic material has a magnetization of 2300 A/m and produces a flux density of 0.00314 wb/m^2, Calculate magnetizing force and permeability of the material.

3(b) Explain the statement 'crystal act as three dimesional grating with X-rays'. Monochromatic X-ray beam of wavelength &lambda = 5.8189 A° is reflected strongly of lattice constant 3A°. Determine Miller indices of the possible reflecting planes. (7 marks)

4(a) Define ligancy. Find the value of critical radius ratio for ligancy 4. (5 marks)

4(b) An impurity of 0.01 ppm is added to Si. The semiconductor has a resistivity of 0.25Ωm at 300K. Calculate the hole concentration and its mobility. Atomic weight of Si is 28.1, density of Si=$2.4\times10^3 kg/m^3$ (5 marks)

4(c) Explain the origin of electronic, ionic and orientational polarization and temperature dependence of respective polarizability. (5 marks)

5(a) The density of copper is $8980 kg/m^3$ and unit cell dimension is 3.61 A°. Atomic weight of copper is 63.54. Determine type of crystal structure. Calculate atomic radius and interplanner spacing of (1 1 0) plane. (5 marks)

5(b) What is Hall effect? Derive expression for Hall voltage with neat labelled diagram. (5 marks)

5(c) Explain how the reverberation time is affected by (i) size (ii) nature of wall surface (iii) audience in an auditorium. (5 marks)

6(a) Estimate the ratio of vacancies at (i) -119°C (ii) 80°C where average required to create vacancy is 1.8eV. (5 marks)

6(b) How a p-n junction diode is used to generate a potential, difference in a photovoltaic solar cell? (5 marks)

6(c) Explain with neat lebelled diagram the construction and working of a piezoelectric oscillator. (5 marks)