Assignment: - 2   **25 March 2020**

Solid State Physics

Instructions:-

1. Last date of Submission 8/4/2020

2. All problems are compulsory.

3. Write your name and class roll number on the top of every page containing solution.

4. Only soft copy in a single PDF format is to be uploaded on whatsapp group/Email.

Maximum Marks:- 10

Objective Questions   2 Marks

1. Hall Effect is observed in a specimen when it (metal or semiconductor) is carrying current and is placed in a magnetic field. The resultant electric field inside the specimen will be in **(0.5 Mark)**
   (a)   A direction normal to both current and magnetic field
   (b)   The direction of current
   (c)   A direction anti parallel to magnetic field
   (d)   An arbitrary direction depending both upon the conductivity of the specimen

2. The Ohm's law for conduction in metals is: **(0.5 Mark)**

   (a) $J = \sigma E$ (b) $J \propto \sigma E$ (c) $J = \dfrac{E}{\sigma}$ (d) $J \propto \dfrac{E}{\sigma}$

3. The conductivity of a semiconductor crystal due to any current carrier is NOT proportional to **(0.5 Mark)**
   (a)   Mobility of the carrier   (b) Effective density of states in the conduction band
   (c)   Electronic charge   (d) Surface states in the semiconductor

4. The mobility of electron in a semiconductor is defined as the **(0.5 Mark)**
   (a)   Diffusion velocity per unit electric field   (b) Diffusion velocity per unit magnetic field
   (c)Drift velocity per unit magnetic field   (d) Drift velocity per unit electric field

Numerical Questions   8 Marks

1. Show that in the cubic crystal, direction [hkl] is perpendicular to the plane (hkl).In the addition, find the interplanar distance between the planes (103) in a cubic crystal with lattice constant of $4\AA$. **(3Mark)**

2. Calculate the diffraction angle for the 1st 2 peaks in Al powder diffraction pattern. **Note that** crystal structure of Al is FCC & lattice constant is 4.04 $\AA$ & x-ray of wavelength is 1.54 $\AA$, Peak of Al (111),(200). **(2Mark)**

3. Debye temp. of iron is 360 k. Calculate the maximum freq. of vibration. **(2 Mark)**

4. Determine the Miller Indices of a plane that makes intercepts of 2Å, 3Å, 4 Å on the co-ordinate axes of an orthorhombic crystal with a:b:c = 4:3:**2 (1Mark)**