

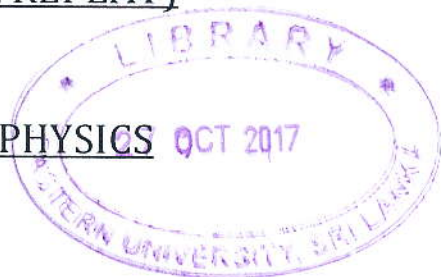
EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2014/2015

SECOND SEMESTER (SPECIAL REPEAT)

(June/July 2016)

PH 304 CONDENSED STATE PHYSICS



Time: 01 hour.

Answer ALL Questions

1. Explain the concept of "Bravias Lattice" and "Basis" in describing a periodic crystal structure.

Give a sketch of diamond structure to illustrate the atomic positions. Identify the *Bravias lattice* and the *basis* that generate the *diamond* crystal structure.

Silicon has a diamond structure with lattice parameter $a=5.43 \text{ \AA}$. Calculate the number of atoms per cubic centimetre. If the atomic mass of silicon is 28.1 a.m.u., find the density of silicon. (1a.m.u.= 1.66×10^{-27} kg).

2. Show that for a the unit cell having lattice parameters (a, b, c), the separation of the planes corresponding to the Miller indices ($h k l$) is given by

$$d_{hkl} = \left[\left(\frac{h}{a} \right)^2 + \left(\frac{k}{b} \right)^2 + \left(\frac{l}{c} \right)^2 \right]^{-\frac{1}{2}}$$

Briefly describe the Bragg's diffraction in crystals and show that the Bragg condition for crystal diffraction on (hkl) planes is given by:

$$2d_{hkl} \sin \theta_{hkl} = n\lambda,$$

Where the symbols have their usual meanings.

Identify the crystal planes given by Miller indices (111), (220) and (330) and determine their Bragg angles for Germanium which has a diamond structure with lattice parameter 5.65 \AA using "Copper K_{α} " X-ray wavelength $\lambda = 0.154 \text{ nm}$.