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

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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 Å. 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 x 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 (
and determine their Bragg angles for Germanium which has a c
structure with lattice parameter 5.65 $A°$ using "Copper K_α" X-ray
wavelength $\lambda = 0.154$ nm.