

Time: 30 Min  
 Date: 28/08/16

Minor-I  
 Closed Book & Closed Notes

Marks: 15

1. A simple hexagonal Bravais lattice has unit vectors:

$$\hat{a}_1 = a\hat{i}, \quad \hat{a}_2 = \frac{a}{2}\hat{i} + \frac{\sqrt{3}a}{2}\hat{j}, \quad \hat{a}_3 = c\hat{k}$$

consider a hexagonal closed packed structure formed by two interpenetrating simple hexagonal Bravais lattice, displaced from one another by

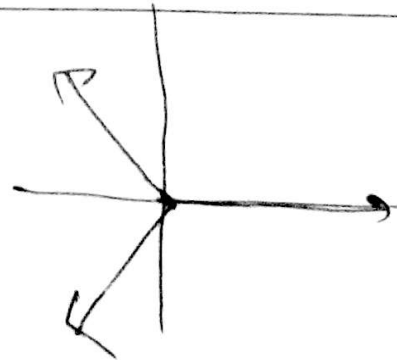
$$\frac{\bar{a}_1}{3} + \frac{\bar{a}_2}{3} + \frac{\bar{a}_3}{2}$$

- [3 Marks] Find the coordinates of all the closed neighbors to the point (0 0 0) on the plane formed by  $\bar{a}_1$  and  $\bar{a}_2$  vectors.
- [3 Marks] Find the coordinates of all the closest neighbors of the point (0 0 0) on the adjacent lattice planes in the  $\hat{k}$  direction.

2. It is given that the phase of a plane wave is same at the points (1 4 6); (0 3 7) and (3 2 8) and the wavelength is  $1.54 \text{ \AA}$ . The **coordinates** of the three points are in  $\text{\AA}$  unit.

- [4 Marks] Find the wave vector  $\vec{k}$ .
- [5 Marks] If this wave is diffracted by a simple cubic monatomic lattice with edge length  $2.178\pi \text{ \AA}$ , find the wave vector of the waves reflected from (1 0 0) planes which give constructive interference.

END



$$\hat{i} + \frac{\hat{j}}{\sqrt{3}}$$

$$\frac{\hat{k}}{2}$$

$$\frac{g}{2}$$


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1

2  
 $\sqrt{3}$