Uva Wellassa University, Sri Lanka
End Semester Examination – Sep./Oct. 2012

Uva Wellassa University

MRT 111-1 Crystallography

Time: One (01) hour

Total four (04) questions
Answer all questions

01) i. Describe the following characteristics of crystal structures giving at least one example from each category.

a. Two-dimensional lattices (05 marks)
b. Primitive and non-primitive unit cells (05 marks)
c. Types of symmetries of structural motifs (05 marks)

ii. How does the combination of various motif symmetries and different 2-D lattices generate symmetry in crystals? Explain briefly.
(10 marks)

02) i. List two assumptions of atomic hard sphere model of crystal structures. Distinguish the major difference between the hard sphere and the reduced sphere models.
(05 marks)

ii. With clear illustrations explain how the ABABAB.... sequence of hexagonal closest packing structure is generated. Indicate the hexagonal unit cell using atomic hard sphere model.
(15 marks)

iii. Draw the face centered cubic (FCC) close packing unit cell using atomic hard sphere model. Derive an expression for its unit cell edge length a in terms of atomic radius R.
(05 marks)

03) i. Explain the relationship between the radii of coordinating anions and the coordinated cation of six-fold coordination in a crystal structure. Draw the corresponding coordination polyhedron.
(05 marks)

ii. Describe the symmetry content of 2/m 2/m 2/m (rhombic dipyramidal) crystal class of orthorhombic crystal system. List the crystal forms of this class with their Miller Indices.
(10 marks)

iii. Describe the six crystal systems with their characteristic/essential symmetries.

(10 marks)

04) Write short notes on the following topics.

a. Derivation of Miller Index of a crystal face (05 marks)
b. Open and closed crystal forms (Give an example for each category) (05 marks)
c. Symmetry elements vs. operations (05 marks)
d. Amorphous vs. crystalline materials (05 marks)
e. Crystal twinning vs. intergrowths (05 marks)