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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**University Village, NnamdiAzikiwe Expressway, Plot 91, Cadastral Zone, Jabi, Abuja**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE & APPLIED SCIENCE**

**JANUARY/ FEBRUARY 2018 EXAMINATION**

**COURSE CODE: PHY307**

**COURSE TITLE:** Solid State Physics 1

**COURSE UNIT: 2 units**

**TIME: 2 hours**

**INSTRUCTION: Answer *Question 1* and *any other three (3) questions***

Q1. a) Define the following

i) crystalline solid ii) lattice iii) crystal structure iv) Bravais and non-Bravais lattice. (6 Marks ; 1.5 Mark each)

b) Prove that the only allowed rotation axis in a two dimensional Bravais lattice are two-, three-, four- and six-folds. (9 Marks)

c) What are rules for Miller indices? (6 Marks)

d) Sketches the following planes (100),, (200), (1 1 0), (111), (222) (6 Marks)

Q2. a)State Bragg’s law of diffraction and give two geometrical facts that is necessary for the derivation of the law. (7 Marks)

b) Electrons are accelerated to 750 V and are reflected from a crystal. The first maximum occurs when glancing angle is 10 0. Determine the interplanar spacing of the crystal. (8 Marks)

Q3. a) Briefly explain the Laue method as one of the experiment for the determination of crystal structure. (7 Marks)

b) X-ray powder photograph of a cubic material with a wavelength of 15.42 nm is taken. In the photograph lines are observed at angles 19.25 0, 22.38 0 , 32.580, 39.150, 41.260, 49.590, 56.080and 58.360. Determine the lattice constant and the nature of the cubic material. (8 Marks)

Q4. a) Briefly explain ionic bonding. (8 Marks)

b) Show that the Madelung for one-dimensional chain is. (7 Marks)

Q5. a) What are the conditions for the validity of Cauchy relations in cubical crystals which are elastically isotropic? (7 Marks)

b) Show that the velocity of a longitudinal wave in the.[111]direction of a cubic

crystal is given by where all symbols have their usual meanings. (8 Marks)