UNIVERSITY OF JOHANNESBURG

SUBJECT : **MATERIAL SCIENCE 2A**

CODE : **MATMIA2**

MAIN EXAMINATION

DATE : MAY 25, 2019

TIME : 8:30 AM to 11:30 AM

DURATION : 3 hrs

TOTAL : 100 Marks

ASSESSOR : Prof. KAPIL GUPTA

MODERATOR : Mr. DOCTOR MUKHAWANA

NUMBER OF PAGES : 3 PAGES

INSTRUCTIONS:

NIL

REQUIREMENTS:

NIL

INSTRUCTIONS TO STUDENTS

1. Read the questions carefully.
2. All questions are compulsory.
3. Number your answers strictly according to the questions.
4. Make use of sketches wherever required.

QUESTION 1 **[20 Marks]**

1a. What are point defects in solids? Explain all three types of point defects with the help of neat sketches. [10]

1b. Write short notes on the following: [6]

(ii) Grain boundaries

(iii) Frankel defects

1c. Defend the statement 'Defects in solids may be desirable or undesirable'. [4]

QUESTION 2 **[20 Marks]**

2a. Define the following terms: [8]

(i) Lattice

(ii) Dipole

(iii) Atomic packing factor

(iv) Dislocations

2b. Sketch and explain a BCC crystal structure. [6]

2c. What are secondary bonds? Differentiate between Van der Waals and Hydrogen bonds. [6]

QUESTION 3 **[20 Marks]**

3a. Sketch stress-strain curve for tensile testing of a ductile material. Show and explain its various points. [10]

3b. Write a note on history and development of engineering materials. [5]

3c. Differentiate between destructive and nondestructive testing. [5]

QUESTION 4 **[20 Marks]**

4a. Write short notes on the following: [12]

(i) Polymerization
(ii) Metal matrix composites
(iii) Heat treatment
(iv) Quantum numbers

4b. Within a cubic unit cell, sketch the following directions: [8]

(i) $[1\ \bar{1}\ 0]$
(ii) [1 1 1]
(iii) [1 0 0]
(iv) [1 1 0]

QUESTION 5 **[20 Marks]**

5a. Draw the crystallographic planes for the following Miller Indices: [9]

(i) (1 0 0)
(ii) (1 1 1)
(iii) (0 0 1)

5b. With the help of neat sketches illustrate the unit cell geometries, and mention axial relationships and interaxial angles of the following crystal systems: [6]

(i) Hexagonal
(ii) Orthorhombic

5c. Present a detailed classification of ceramics on the basis of applications. [5]

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