NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OFAPPLIED SCIENCES

DEPARTMENT OF APPLIED PHYSICS

BSc (Hon) in Applied Chemistry

ENGINEERING MATERIALS

SPH 1209

Second Semester Examination Paper

May 2025

This examination paper consists of 3 pages

Time Allowed: **3 hours**

Total Marks: **100**

Special Requirements:None

Examiner's Name: **Mr Z. Zulu**

INSTRUCTIONS

ANSWER ALL PARTS OF QUESTION 1 IN SECTION A AND ANY THREE QUESTIONS FROM SECTION B. SECTION A CARRIES 40 MARKS AND SECTION B CARRIES 60 MARKS.

MARK ALLOCATION

QUESTION	MARKS
1.	40
2.	20
3.	20
4.	20
5.	20
6.	20
Maximum possible mark	100

SECTION A

1. (a) .Distinguish between Frenkel and Schottky defects. [4]

(b) Discuss at least three factors that one would consider in choosing a material for a specific task. [9]

(c) Define the following properties of materials.

(i) Conductivity. [2]
(ii) Ductility. [2]
(iii) Hardness. [2]
(iv) Stiffness. [2]

(d) State two examples of a Solid Solution. [2]

(e)

(i) Define a Composite and state one of its use. [3]
(ii) Define metal. [2]

(f)

(i) Derive the relation between the lattice parameter and atomic radius for a Body Centered Cubic (BCC). [4]
(ii) Hence or otherwise calculate the volume of a BCC lattice with atoms of radius 0.175nm. [5]

(g) Explain why Borosilicate glasses are resistant to thermal shock. [3]

SECTION B

2. (a) Define Hardenability. [2]

(b) Describe the following techniques;

i) Solid Solution Hardening. [6]

(ii) Strain Hardening. [6]

(iii) Grain Size Reduction Hardening. [6]

3.

(c) Describe the Vickers Hardness test procedure. [6]

(d) State the main material tests that one would carry on a structural polymer and give reasons why you chose each of those specific tests [6]

4. (a) Briefly describe the procedures of the following tests on a polymer and sketch fully labelled graphical results for each test.

(i) Fatigue test. [6]

(ii) Tensile test. [7]

(iii) Creep test. [7]

5. (a) Define a ceramic. [2]

(i) State the different types of ceramics. [4]

(b) Give two different applications of ceramics and state which property(s) suits that application. [6]

(c) Discuss the choice of materials stating why you chose then to use for the following task:

(i) A container to carry a corrosive gas. [4]

(ii) A cold room [4]

6. (a) Discuss the differences between composites and alloys. [6]

(b) Explain the advantages of using fibre glass in the transport industry. [6]

(c) Distinguish between thermosetting and thermoplastic polymers giving an application for each material. [8]

END OF PAPER