



UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: DGE 1103
COURSE	: MATERIALS SCIENCE
SEMESTER/SESSION	: 1-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 5 questions. Answer **ALL** questions.
2. All answers should be written in the answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 4 PRINTED PAGES INCLUDING THE COVER PAGE

INSTRUCTION

Answer **ALL** the questions.

QUESTION 1

- a. Classify the four main types of materials. List down their properties and examples for each of them.

(8 Marks)

- b. Identify **THREE (3)** differences between metals and non-metals.

(6 Marks)

QUESTION 2

- a. Discuss the definition, properties, and application of the following non-metal:

- i. Brass
- ii. Bronze
- iii. Aluminium Alloy 2xxx series
- iv. Aluminium Alloy 5xxx series
- v. Aluminium Alloy 6xxx series

(15 Marks)

- b. Compare the properties and applications of two ferrous metals, namely stainless steel and cast iron, considering their composition, **two (2)** mechanical properties, and **two (2)** industrial uses.

(14 Marks)

QUESTION 3

- a. Classify **SIX (6)** differences between natural and synthetic polymers and provide examples for each category. (12 Marks)
- b. Explain the properties of glass. (6 Marks)
- c. Determine the chemical composition of cement. (5 Marks)
- d. Describe **THREE (3)** main categories of ceramics based on their composition and provide examples for each category. (6 Marks)

QUESTION 4

- a. Sketch the graph of the stress-strain curve and give an explanation of the curve. (8 Marks)
- b. Given a spring with a stiffness constant (k) of 300 N/m and a force of 120 N acting on it, determine the deformation. (2 Marks)
- c. A copper wire is stretched by a force of 600 N, causing it to elongate by 0.2 mm. Calculate the spring constant (k) of the wire. (2 Marks)
- d. A force of 500 N causes an increase of 0.5% in the length of a wire of an area of cross-section 10^{-6} m^2 . Calculate Young's modulus of the wire. (2 Marks)

QUESTION 5

- a. Explain Ohm's Law in your own words. (2 Marks)
- b. State **THREE (3)** variables involved in Ohm's Law. (3 Marks)
- c. Relate the practical applications of Ohm's Law in everyday life or various electrical devices. (3 Marks)
- d. Identify three primary factors that influence the electrical resistivity and conductivity of a substance (3 Marks)
- e. A cylinder rod made of a material with resistivity 3×10^{-7} ohm-meter has a length of 1 meter and a resistance of 5 ohms. Determine the radius of the rod. (3 Marks)

*****END OF QUESTIONS*****