UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UCTATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: BPE 2184
COURSE	: PLASTICS PROPERTIES & TESTING
SEMESTER/SESSION	: 2-2023/2024
DURATION	: 3 HOURS

Instructions:

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

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

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Label a general stress-strain diagram for a typical polymeric material. In the diagram, include all these points: (4 marks)

i. Yield point
ii. Rupture point
iii. Strength at break
iv. Strain at break

b) A piece of polypropylene, originally 305mm long is pulled in tension with a stress of 276 MPa. It's Young's Modulus is 110MPa. The deformation is entirely elastic.

i. Find the strain difference of the material ($\Delta \varepsilon$). (4 marks)

ii. If the original length of polypropylene is 305mm, compute the change in length after it is being pulled. (4 marks)

QUESTION 2

a) Define the definition of viscoelastic. (2 marks)

b) The Melt Flow Index (MFI) is a measure of the ease of flow of the melt of a thermoplastic polymer. Demonstrate the melt flow index (MFI) test procedure. (8 marks)

c) Stress relaxation is a time-dependent decrease in stress under a constant strain. This characteristic behaviour of the polymer is studied by applying a fixed amount of deformation to a specimen and measuring the load required to maintain it as a function of time.

i. Interpret the mechanisms of stress relaxation in terms of molecular movement. (8 marks)

ii. Identify the importance of stress relaxation. (4 marks)

QUESTION 3

a) Determine **two (2)** factors that affects the ductile-brittle change of polymeric materials. Include example to assist your explanation.

(8 marks)

b) Environmental stress cracking, is a phenomenon that occurs when a polymer, undergoes brittle cracking in the presence of both mechanical stress and certain environmental conditions.

i. Explain **two (2)** mechanisms involved in environmental stress cracking.

(8 marks)

ii. Identify **three (3)** preventive methods to avoid environmental stress cracking in plastic materials.

(6 marks)

QUESTION 4

a) Analyse the importance of tensile testing in determining the mechanical properties of polymers.

(4 marks)

b) Tensile and flexural tests are among tests conducted in order to determine the mechanical properties of a polymeric material. Differentiates between the two tests.

(8 marks)

c) The impact resistance of polymers is an important property in many applications. Describe the different methods of impact tests commonly used to evaluate the impact resistance of polymers.

(6 marks)

d) Give the procedure for conducting Durometer hardness test.

(4 marks)

QUESTION 5

a) Differentiates between HDT, Tg, Tm and decompose temperature in terms of **chain movement**.

(8 marks)

b) The heat deflection temperature is a property of a plastic material and it is applied in many aspects of product design, engineering and manufacture of products using thermoplastic components.

i. Interpret the meaning of a material having HDT/DTUL at 72°C.

(4 marks)

ii. Show the method to conduct HDT/DTUL test. You must include the dimension of the specimen and also drawing to illustrate the process.

(8 marks)

iii. Give is the ASTM code for HDT/DTUL standard test method.

(2 marks)

----------End of questions----------