



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY  
FACULTY OF ENGINEERING  
DEPARTMENT OF FIBRE & POLYMER MATERIALS ENGINEERING  
POLYMER ENGINEERING II  
TFE 2201

Second Semester Examination Paper

MARCH 2025

This examination paper consists of 2 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: N/A

Examiner's Name: Mrs S Moyo

**INSTRUCTIONS**

1. Answer **QUESTION ONE** and **ANY OTHER THREE** questions.
2. The first fifteen minutes should be spent reading the question paper and making notes.
3. **Do not** open your answer sheet until told to do so.
4. Marks will be awarded for skill in appreciating the scope of questions, clarity of argument and conciseness of presentation as well as for the knowledge displayed by the candidate.

**MARK ALLOCATION**

QUESTION	MARKS
1	25
2	25
3	25
4	25
5	25

### **QUESTION 1**

- a. Define the following terms in relation to polymer fracture mechanisms:
- i. Tensile strength
  - ii. Young's modulus
  - iii. Elongation at break
  - iv. Yield strength
  - v. Fracture **[5 Marks]**
- b. Using clear stress-strain curves, compare and contrast brittle fracture and ductile fracture. **[10 Marks]**
- c. Discuss the factors affecting the glass transition temperature of polymers. **[10 Marks]**

### **QUESTION 2**

- a. Explain how 'necking' increases the toughness of polymers. **[5 Marks]**
- b. Discuss the factors that determine the strength of polymers. **[10 Marks]**
- c. Discuss three different methods of increasing the toughness of polymeric materials. **[10 Marks]**

### **QUESTION 3**

- a. Define creep and outline the factors upon which creep resistance depends on. **[5 Marks]**
- b. Describe how creep can lead to an engineering component failing to perform its intended function. **[5 Marks]**
- c. With the aid of graphs, detail the three properties of viscoelastic materials. **[15 Marks]**

### **QUESTION 4**

- a. Briefly discuss the different methods used to retard polymer degradation. **[10 Marks]**
- b. Describe the methods of thermal degradation in polymers and detail the effects of this type of degradation on the bulk structure of the polymer giving examples. In your discussion also include remedies that may be available to mitigate this phenomenon **[15 Marks]**

### **QUESTION 5**

Discuss the significant advancements that have been made in polymer materials and technology field in the recent years. **[25 Marks]**

**END OF EXAMINATION QUESTION PAPER**

Page 2 of 2

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