

# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

## DEPARTMENT OF TEXTILE TECHNOLOGY

END OF SEMESTER EXAMINATIONS DECEMBER 2003

TEXTILE MATERIALS TXT 1104

TIME: 3 HOURS

### INSTRUCTIONS

Answer **ALL** questions from Section A and **ANY 4** from section B. Section A carries 40 marks and each question in section B carries 20 marks. Allocate 60 minutes to section A and 120 minutes to section B.

### SECTION A

Answer **ALL** questions in this section.

1. Discuss the key features of the cellulose molecule which are responsible for the development of fine-structure in cellulose-based fibres.
2. (a) What are the most distinguishing properties of artificial protein based fibres? (2 marks)  
(b) Define aramid fibres and give two examples of such fibres. (3 marks)
3. (a) Compare and contrast the characteristics of any two bast fibres. (2 marks)  
(b) Write down the structures of the side chain of any three  $\alpha$ -amino acid (except for glycine) that are found in wool. (3 marks)
4. (a) Wool's moisture absorption is of its most important characteristics. Why? (3 marks)  
(b) Which natural fibre is mostly used in the manufacture of sacks and why? (2 marks)
5. (a) Name two types of worms that produce silk and briefly explain their differences. (3 marks)
6. (a) What is the action of alkalis on wool? (2 marks)  
(b) What properties characterise fibre forming polymers? (3 marks)
7. (a) Describe the effect of heat on viscose. (2 marks)

- (b) Compare and contrast the stress-strain behaviour of spandex and nylon. (3 marks)
8. (a) How is fibrillation generated in Tencel and in what way does it affect properties of the fibre. (3 marks)
- (b) How is it that 100% poly-acrylonitrile is not useful on a fibre? (2 marks)

## **SECTION B**

Answer any **THREE** questions in this Section.

1. (a) “Many polymers exist in a rather ambiguous state: neither exactly liquid not exactly solid, but somewhere between the two.” Discuss the validity of this statement. (7 ½ marks)
- (b) In the manufacture of both regenerated and synthetic fibres, what are the general steps followed? (7 ½ marks)
- (c) How is silk formed and what its chemical compositions? (5 marks)
2. (a) List down the main natural, organic fibres according to the classes and subclasses. (5 marks)
- (b) Write down the equation for the production of the polymer that forms the fibre commercially known as Dacron. (10 marks)
- (c) Explain what is meant by each of the following:  
(i) a “homopolymer”  
(ii) a “block copolymer”  
(iii) a “random copolymer”  
(iv) chain branching  
(v) cross-linking (5 marks)
3. (a) Explain with aid of equations, the different in preparation of nylon 6.6 and nylon 6 fibres from raw materials. (15 marks)

- (b) Discuss the properties of Nomex. ( 5 marks)
4. (a) Write down the acetylation reaction that leads to the production of triacetate? (10 marks)
- (b) Explain the differences in characteristics, performance and structure acrylic and modecrylic fibres. (10 marks)
5. (a) Write down the equations for the production of polymers from which the polyester fibres are produced. (10 marks)
- (b) What are the applications of Kevlar fibres? (5 marks)
- (c) What are the end uses of fibres from flax and ramie. (5 marks)

**END OF QUESTION PAPER**