



THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF INDUSTRIAL STUDIES/

BACHELOR OF TECHNOLOGY

FINAL EXAMINATION 2014

TTX5131- STRUCTURE AND PROPERTIES OF FIBERS

DURATION THREE (3) HOURS

DATE: 07-09-2014

TIME: 930-1230 HOURS

Answer Question Number one (1) of Part I, which is compulsory and five (5) more questions from part II. Question number 1 carries 25 marks and others carry fifteen (15) marks each.

PART I

01. a) What are the properties or requirements that should be looked into in deciding whether the polymer is suitable for production of textile fibers? **(05 Marks)**
- b) "As a rule entropy decreases ($\Delta S < 0$) upon polymerization of a monomer"
Do you agree? **(02 Marks)**
- c) Give reasons for your answer to (b) above. **(03 Marks)**
- d) Explain briefly "chain-growth propagation" and "step growth propagation" **(04 Marks)**
- e) How does "Dispersion Forces" or "Van der Waal forces" occur between molecules? **(02 Marks)**
- f) What are the factors that favor the process of crystallization of fiber molecules? **(04 Marks)**
- g) In a fiber forming polymer, how are the highest possible order and highest possible disorder of elementary cells known? **(02 Marks)**
- h) What do you understand by hydrophilic and hydrophobic textile fibers? **(03 Marks)**

PART II

1. a) Polymers can be classified as homo-polymers, random copolymers, alternating copolymers, block copolymers and graft copolymers, based on the chemical composition of polymer chains in terms of arrangement of monomers in the polymer molecules.

If A, B and C are the monomers, illustrate the chain rearrangement of the above five (5) polymers. **(08 marks)**

- b) What are the optimal properties of polymer molecules required for fiber formation? **(04 marks)**

- c) What are the basic building blocks of cotton, wool and polyester fibers? **(03 marks)**

2. a). Distinguish between “Glass Transition Temperature” and “Melting Point”. **(04 Marks)**

- b) What are the factors that influence the glass transition temperature of polymers? **(04 Marks)**

- c) How does water or moisture affect the Glass Transition Temperature, and how is this reflected in ironing a cotton garment, with an steam iron? **(02 marks)**

- d) Compare and contrast the three major types of processes used for spinning synthetic fibers. **(05 Marks)**

- 3 Compare and contrast the following:

- a) Condensation polymerization and addition polymerization. **(05 Marks)**

- b) Thermal properties of thermoset and thermoplastic polymer materials. **(05 Marks)**

- c) Crystalline and amorphous nature of polymer structures. **(05 Marks)**

4. What do you understand by

- a) Di-functional monomers. **(05 Marks)**

- b) Inter-molecular interaction in polymer chains. **(05 Marks)**

- c) Packing density of fibers. **(05 Marks)**

5. a) There are three fibre materials suspected to be cotton, wool and silk. The samples are randomly marked as A, B and C. certain tests were performed on these fibres, and the results were as follows. Identify the fibres, marked as A, B and C.

Test	Sample A	Sample B	Sample C
80% H ₂ SO ₄	Dissolves	Insoluble	Dissolves to a certain extent
5% NaOH	Swells	Dissolves	Dissolves
Cupramonium Hydroxide	Slowly dissolves	swells	Dissolves slowly

(09 marks)

A is

B is

C is

- b). Write short notes on the following.

(i) Flame resistant Textiles (ii) Flame Retardant Textiles

(06 Marks)

6. a) What are the parameters that can influence the heat-setting efficiency of synthetic fibres? (05 marks)

b) Briefly explain the changes taking place in a fibre during heat setting.

(05 Marks)

c) If a material of high dielectric property is brought between the two plates of a condenser, how does that affect the capacitance of the condenser? (03 marks)

d). How does moisture affect the static electricity charge in textile material? (02 marks)