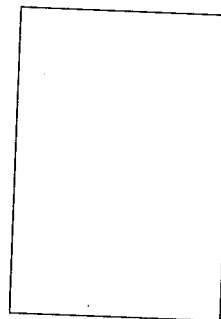


THE OPEN UNIVERSITY OF SRI LANKA  
 BACHELOR OF INDUSTRIAL STUDIES/  
 BACHELOR OF TECHNOLOGY  
 FINAL EXAMINATION - 2006  
 TTX5131 FIBRE STRUCTURE AND PROPERTIES  
 DURATION THREE (3) HOURS



DATE: 10<sup>TH</sup> March 2007

TIME: 930-1230 HOURS

Answer Question Number one (1) which is compulsory and five (5) more questions. Question number one carries 25 marks and others carry fifteen (15) marks each.

01.a) State the three classical methods of producing man-made fibres. (3 marks)

b) Briefly explain each of the above processes. (6 marks)

c) Why is it impossible to design or produce an ideal fibre, satisfying all the required properties? (1 mark)

d) Polymers can be classified based on the chemical composition of polymer chains in terms of arrangement of monomers in the polymer molecules. If A, B and C are monomers, identify the following polymers based on the arrangement of monomers in the polymer molecule. (5 marks)

i. -A-A-A-A-A-A-A-

ii. -A-A-B-A-B-A-A-B-B-

iii. -A-B-A-B-A-B-A-B-A-B-

iv. ...-A-A-A-A-B-B-B-B-

|  
B

|

B

v. -A-A-C-A-B-A-A-C-C-B-B-



e) What are the two basic polymerisation mechanisms? (2 marks)

- f) Four conditions have to be satisfied, to polymerise a monomer.  
What are these four conditions? **(4 marks)**
- g) What is the purpose of adding  $\text{TiO}_2$  to a fibre spinning polymer.  
**(1 mark)**
- h) What is dope dyeing? **(1 mark)**
- i) A yarn manufacturer finds that the tenacity of the manufactured yarn is lower than the standard value. What are the options he has to correct this situation;  
i) in the polymerisation stage  
ii) after the spinning process **(2 marks)**
- 02.a. Distinguish between “Glass Transition Temperature” and “Melting Point”. **(7 marks)**
- b. What are the factors that influence the glass transition temperature of polymers? **(8marks)**
03. What do you understand by “Crystallinity” of polymers? What are the factors that favour and hinder crystallization? What are the pre-requisites for a stable crystalline region? What is the other “limit of order” of a fiber-forming polymer? How do these two states contribute to the characteristics of a yarn formed out of a fibre forming polymer? **(15 marks)**
04. What do you understand by “orientation” and “degree of orientation” ? Explain the mechanical process by which the orientation of the polymer molecules of the yarn is enhanced. What are the properties of the yarn that undergo changes from undrawn to drawn stage as a result of this process ?  
**(15 Marks)**
05. Polymer molecules have to fulfil certain requirements to be successfully used for textile fibre formation. What are these requirements and why are they important? **(15 marks)**
- 06, There are two models, namely “Porous Model” and “Free Volume Model”, to explain the diffusion of dyes into fibre.  
Explain these two models. **(15 marks)**

07 a) Explain the following terms. (3 marks)

- i. Flammable textiles
- ii Flame-resistant textiles
- iii. Flame retardant textiles

b) There are four theories proposed that provide the basis for imparting flame retardant treatments on textiles. They are Chemical Theory, Thermal Theory, Gas Theory and Coating Theory.

Explain these four theories. (12 marks)

08.a) Arrange the following fibres starting from the fibre with the lowest moisture regain and ending with the fibre with highest moisture regain.

*Fibres: Viscose, Acetate, Cotton, Nylon, Wool, Silk, Polyester* (3 marks)

b) There are four different types of moisture in textile fibres namely binding, capillary, chemical and swell moisture. Explain each of these.

(12 marks)

09 a) Give two examples for the problems caused by static electricity during processing of fibres/yarn or usage of fibre based material. (4 marks)

b) Arrange the following fibres in order, as an Electrostatic Series starting from the lowest negatively charged to the highest positively charged.

(4 marks)

*Fibres: Silk, Viscose, Acrylic and Wool*

c) A sample of 20 Tex yarn of mass 2.15g , was found to have an oven dry mass of 1.95g. If the regain is in a standard temperature and atmosphere should be 9%, what is the linear density of the yarn under these conditions. (7 marks)