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THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF INDUSTRIAL STUDIES /

BACHELOR OF TECHNOLOGY

FINAL EXAMINATION – 2005 / 2006

TTX5232 YARN AND FABRIC MECHANICS

DURATION - THREE HOURS

DATE: 26th March 2006 **TIME: 09.30 – 12.30HOURS**

Total Number of Questions = 8 **Number of questions to be answered = 05**

Answer the question 1, which is compulsory, and four (04) additional questions. Question 1 carries twenty eight (28) marks and questions 2 to 8 carry eighteen (18) marks each.

01. Compulsory Question

a) Distinguish between "Mechanics and "Mechanics of solids".

b) Give a graphical presentation to show the characteristic stress/strain behaviour of a textile fibre and indicate the "Initial Modulus" in your presentation.

c) Show the following quantities in a diagram showing the time effect on extension and recovery of fibres: Primary Creep, Secondary Creep and Permanent Creep.

d) Explain in brief how bending rigidity depends on the cross-sectional dimensions of the structure concerned.

e) "The frictional behaviour of textile fibres is different to the behaviour of other solid engineering materials." Briefly explain this statement.

f) What is an "Elastomeric Yarn"?

g) Briefly Explain what you understand by 'Idealised Helical Structure of Yarns ".

h) Illustrate some characteristic **experimental** curves of stress/strain behaviour of filament yarns with different twists.

i) What do you understand by "Crimp Interchange"?

j) Pierce derived the following relationship for the geometry of plain weave fabrics:

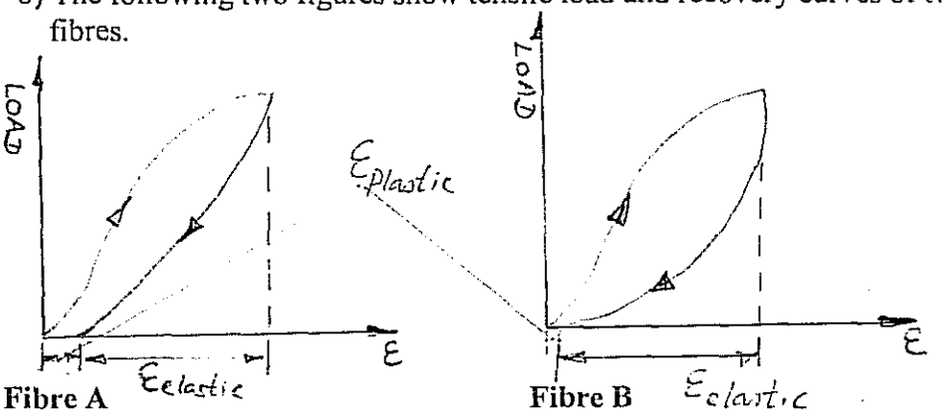
$$h_1 = \frac{4}{3} p_2 \sqrt{c_1}$$

What do you understand by these symbols h_1, p_2 and c_1?

02. a) Define the following terms:

Work of rupture, Work factor, Yield point

b) The following two figures show tensile load and recovery curves of two types of fibres.



Which fibre has

(i) the higher elastic recovery?

(ii) the higher work recovery?

c) Which of the above two fibres is more suitable to make a fabric with better dimensional stability.

03. a) Discuss why laws of friction applied to rigid solids are not directly applicable to textile fibres, elaborating the effect of area of contact, surface lubrication and atmospheric conditions.

b) Explain how the diameter of a yarn guide affects the friction between the guide and a textile yarn going around the guide.

04. a) Define the terms "The average fibre segment length" and "The mobility or freedom of movement" as fundamental structural features of fibres.

b) Give two sketches to illustrate "Idealized Open Packed" and "Hexagonal Close Packed" Structures of yarns..

05. a) Explain how the process of ring spinning affects the hairiness of ring-spun yarns.

b) Which fibres tend to produce more hairs when a blend of shorter and longer fibres is spun to a yarn? Give reasons for your answer.

c) Discuss the effect of fibre fineness on yarn hairiness.

06. a) List and explain all the assumptions underlying the helical geometry of yarns.

b) Explain why a staple yarn having idealized helical geometry would be a useless product.

07. a) What are the assumptions underlying Pierce's original model of plain weave fabric.

b) Draw a cross sectional view of a plain weave fabric to show all the important geometrical parameters used in the Pierce's original model and derive the relationship between warp and weft crimp heights and sum of warp and weft diameters.

c) A plain-woven fabric has 48 ends/inch and 55 picks/inch. If the warp and weft crimps are 4.5% and 9.5% respectively, determine the sum of the diameters of the yarns.

08. a) Discuss the reasons for the introduction of Pierce's alternate theories and Kemp's Race-track theory of fabric geometry.

b) Draw two cross-sectional views of a plain-weave fabric to show all the important geometrical parameters used in Pierce's Elliptical Model and Kemp's Race-track Model.

c) What are the advantages of using the Race Track Model instead of Elliptical Model?