THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF INDUSTRIAL STUDIES /

BACHELOR OF TECHNOLOGY

FINAL EXAMINATION – 2006 / 2007 011

TTX5232 YARN AND FABRIC MECHANICS

DURATION - THREE HOURS

DATE: 21st March 2007 **TIME: 09.30 – 12.30HOURS**

Total Number of Questions = 8 **Number of questions to be answered = 06**

Answer the question 1, which is compulsory, and five (05) additional questions. Question 1 carries twenty five (25) marks and questions 2 to 8 carry fifteen (15) marks each.

01. Compulsory Question

a) Compare the most important properties/characteristics of common engineering materials with those of textiles. (2.0 Marks)

b) Give a graphical presentation to show the characteristic stress/strain behaviour of a textile fibre and indicate the "Work of Rupture" in your presentation. (2.0 Marks)

c) Give a graphical presentation to show the typical tensile loading and recovery curves of a textile fibre and indicate the "Recovered Work" and "Elastic Extension" in your presentation. (2.0 Marks)

d) What do you understand by "Relaxation"? (1.5 Mark)

e) What is "Torsional Rigidity"? (1.5 Mark).

f) State the two Amonton's laws of friction. (2.0 Marks)

g) What do you understand by "Fibre Migration" in textile yarns? (2.0 Marks)

h) What is the most significant difference between the structures of ring spun and rotor spun yarns? (2.0 Marks)

i) Explain how the gauge length of a yarn affects the load extension behaviour and the nature of rupture of the yarn. (2.0 Marks)

j) What are the different categories of fibres that are in the yarn which are considered as yarn hairiness? (1.5 Marks)

h) What is crimp? (1.5 Marks)

i) Sketch warp way and weft way cross sections of a plain weave fabric and show the following dimensions: Warp spacing, Weft Spacing, Warp crimp height, Weft Crimp height and Fabric Thickness (5.0 Marks)

02. a) With the help of a suitable diagram or other wise, define the terms, immediate elastic deformation, recovered (primary) creep and permanent (secondary) creep. (07 Marks)

b) Visco-elastic behaviour of textile fibres can be analysed by employing models made of ideal elastic springs and ideal viscous dashpots. Explain how relaxation behaviour is illustrated by the Maxwell model of springs and dashpots. (08 Marks)

03. a) The Ammonton's laws of friction are not applicable to textile fibres. Discuss the reasons why they can not be applied to textile fibres with respect to all properties of textile fibres. (10 Marks)

b) Explain how the surface lubrication would affect the friction between a fibre and a solid object. (05 Marks)

04. a) Explain why we do not observe any migration of steel wires used in steel cables, although they are also twisted like continuous filament yarns. (07 Marks)

c) Discuss the statement "Staple fibre yarns without migrating fibres (i.e. yarns having the idealized helical geometry) are of little use for any textile application". (08 Marks)

05. a) What is ideal migration? (04 Marks)

b) What do you understand by "Wild Fibre"? (04 Marks)

c) Explain the occurrence of hairiness of staple yarns in relation to migration of fibres and twisting during spinning. (07 Marks)

06. a) Compare and discuss the two methods of predicting the breakage of filament yarns:

i) Assuming a catastrophic rupture and

ii) Under the assumption that unbroken filaments are effective after commencement of the breakage. (10 Marks)

b) Explain "Stress Analysis by Energy Method" by highlighting the merits and demerits of this method over geometrical models. (05 Marks)

07. What is "the revised qualitative approach" introduced by Hearle et. al. to explain the effect of twist on yarn strength? Explain with suitable diagrams and compare against the traditional view. (15 Marks)

08. a) Show that $d = 1/28\sqrt{N}$

Where, d = Diameter of the yarn
N= English Cotton Count of the yarn

Assume a specific volume of 1.1 cm^3/g for the fibre from which the yarn is made. (10 Marks)

b) State all the assumptions made by Pierce in the development of his mathematical model for plain weave fabrics. (05 Marks)