THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF INDUSTRIAL STUDIES /
BACHELOR OF TECHNOLOGY
FINAL EXAMINATION – 2012 / 2013
TTX5232 YARN AND FABRIC MECHANICS
DURATION - THREE HOURS

DATE: 31st July 2013 **TIME: 0930 – 1230 Hours**

Total Number of Questions = ඊ ය Number of questions to be answered = 06
Answer the question 1, which is compulsory, and five (05) additional questions.
Question 1 carries thirty (30) marks and the questions 2 to 7 carry fourteen (14) marks each.

01. Compulsory Question

a) Why we should be very careful in the application of classical theories of solid mechanics to textile materials? (02 %)

b) Distinguish between "ultimate tensile strength" and "tenacity" as applied for textile fibres. (02 %)

c) Define the term"Creep"? (02 %)

d) What is torsional rigidity? (02 %)

e) What is the most distinguishable internal structural difference observed between ring-spun and OE yarns? (02 %)

f) A filament yarn consists of 19 filaments of circular cross section. Sketch the cross-section of the yarn assuming an open-packing structure. (03 %)

g) What are "Wild Fibres" according to Morton? (02 %)

h) What are the two laws of friction according to Amontons? (04 %)

i) What do you understand by "catastrophic rupture"? (03 %)

j) How does the twist influence the initial modulus of twisted multi-filament yarns. (02 %)

k) How does the twist affect breaking extension of multi-filament yarns? (02%)

l) What is the relationship between the diameter and the direct count of a yarn? (02%)

m) What is fractional warp cover? (02%)

02. a) What is yield point of a fibre? Explain how yield point of a stress/strain curve can be determined by

(i) Meredith's construction

(ii) Coplan's construction. (08%)

b) Draw the graphs of characteristic tensile stress/strain behavior of the following fibres: Flax, Cotton, Viscose and wool. (03%)

c) Which of the above fibres has the best and which has the worst dimensional stability under tensile loads? (03%)

03. a) What is flexural rigidity? (02%)

b) Flexural rigidity of a textile fibre is given by the following formula:

$$\text{Flexural rigidity} = \frac{1}{4\pi}\,\eta.\frac{ET^2}{\rho}$$

η is the shape factor.

i) What is shape factor? Discuss its importance. (04%)

ii) What are E, T and ρ? (02%)

c) What is specific flexural rigidity? How does it affect bending behaviour of a fibre? (06%)

04. a) If you compare a steel cable made by twisting of steel wires and a twisted multi-filament yarn, their structures are not similar. What difference do you observe and what is the reason for this difference? (05 %)

b) Explain what internal structural feature of the yarns made out of staple fibres is responsible in providing them with acceptably high strengths? (05%)

c) Explain the term "**preferential radial migration or coring**". (04 %)

05. a) "As more twist is added to continuous filament structures, the tensile strength of the yarn decreases." Do you agree with this statement? Give reasons for your answer. (06 %)

b) What is the "**revised qualitative approach**" introduced by Hearle et. al. to explain the effect of twist on the strength of staple yarns? Explain with suitable diagrams. (08 %)

06. a) Discuss why Ammonton's laws of friction are not applicable to textile fibres and yarns. (08 %)

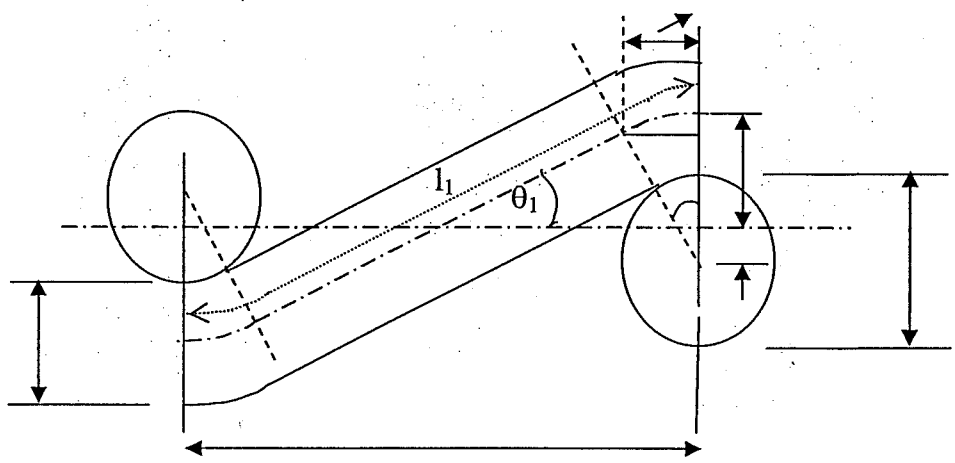
b) Explain how following factors would affect the frictional force between a textile fibre or yarn threaded around a solid guide:

i) Surface lubrication of the yarn/fibre (04 %)

ii) diameter of the guide (03 %)

07. a) State all the assumptions made by Pierce in the development of his mathematical model for plain weave fabrics. (08 %)

b)



i) The above Figure shows a cross sectional view of a plain weave fabric. Redraw the figure and complete all not indicated dimensions. (03%)

ii) Derive the following equation:

$$p_2 = (l_1 - D\theta_1)\cos\theta_1 + D\sin\theta_1, \text{ where } D = d_1 + d_2 \quad (04\ \%)$$

08. a) What is the reason for introducing Racetrack Geometry by Kemp? (02%)

b) What is thread flattening coefficient? (02%)

c) Explain why is it necessary to consider the weave repeat as a whole, while we deal with the geometry of non-plain fabrics. (03%)

d) If the length of a weave repeat is p_r and it has n_i intersections and n_f floats. Derive an equation to give p_r in terms of the lengths of intersection (p_i) and floats (p_f). (03%)

e) Explain how p_i varies in relation to width of the yarn cross section in low sett, medium sett and high sett fabrics. (04%)