THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF INDUSTRIAL STUDIES /

BACHELOR OF TECHNOLOGY

FINAL EXAMINATION – 2010 / 2011

TTX5232 YARN AND FABRIC MECHANICS

DURATION - THREE HOURS

DATE: 09th March 2011 TIME: 0930 – 1230 Hours

Total Number of Questions = 7 Number of questions to be answered = 05
Answer the question 1, which is compulsory, and four (04) additional questions.
Question 1 carries thirty (30) marks and the questions 2 to 7 carry fourteen (14) marks each.

01. Compulsory Question

a) Distinguish between "Mechanics and Mechanics of Solids". (02 %)

b) Define the following terms:
Elastic Recovery, Work Recovery (02 %)

c) What is meant by "Relaxation"? (02 %)

d) What is meant by "Flexural Rigidity"? (02 %)

e) Distinguish between "High bulk yarns", "Stretch Yarns" and "Elastomeric yarns". (03 %)

f) What is "Twist Factor"of a yarn? (02 %)

g) What ia meant by "Fibre Migration" in textile yarns? (02 %)

h) What is meant by "Hexagonal closed packed" structure as applied in twisted textile yarns? (02 %)

i) What is "Wild Fibre" according to Morton? (02 %)

j) Mention two categories of fibres in a yarn considered as hairiness. (02 %)

k) Give an illustration to show the effect of gauge length on the stress/elongation behaviour and breaking strength of yarns. (02%)

l) Illustrate some characteristic **experimental** curves of stress/strain behaviour of filament yarns with different twist. (03%)

m) What is the main reason for the introduction of Peirce's alternate theories such as elliptical theory and approximate circular theory? (02%)

n) What is "Crimp interchange" in a fabric? (02%)

02. a) The following statements are made of three different fibres:

(i) Glass has very high specific stress but a very low strain at break, and stress is linearly proportional to the strain.

(ii) A texturised synthetic fibre has a high specific stress and a very high strain at break, and the stress / strain curve has an initial flat due to de-crimping. It also has a very clear yield point.

(iii) Cotton has comparatively low stress and strain values at break and stress/strain curve is slightly concave to the extension axis with no clear yield point.

Draw the stress/strain curves of the above three fibres and label the figure to show breaking stresses, breaking strains and yield points. (10%)

b) What is meant by "Hysteresis Loop of Recovery"? (04%)

03. a) When yarns are twisted they contract because of the longer path followed by the fibres. This contraction is given by two parameters, ***contraction factor C_y and retraction R_y.*** Define these two factors. (04 %)

b) Derive the relationship between the ***contraction factor C_y and the retraction R_y.*** (05%)

c) State the range of values, which can be taken by these two factors and their usefulness in yarn formation. (05%)

04. The following figure shows two models suggested to represent how fibres are packed in the cross section of a twisted yarn.

I. 

II. 

a) What are the two names used to identify these two models. (02%)

b) Calculate the percentage of yarn cross section area covered by the fibres in both the models. (06%)

c) In practice neither of the above models is achieved. There are factors operative in determining the real yarn structures, which can be divided into those, which tend to concentrate the structure into a close-packed form, and those which tend to disturb the idealized structure. State **the two factors which tend to concentrate** the structure into closed packed form. (06%)

05. 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 %)

b) Explain "Stress Analysis by Energy Method" by highlighting the merits and demerits of this method over geometrical models. (04 %)

06. It is known that when yarn twist is increased yarn strength rises to a maximum level and then decreases.
a) How is this phenomenon explained traditionally? (06%)
b) What is "the revised qualitative approach" introduced by Hearle et. al. to explain the effect of twist on yarn strength? (08%)

07. a) Discuss the reasons for the introduction of Pierce's alternate theories and Kemp's Race-track theory of fabric geometry. (05%)

b) Draw two cross-sectional views of a plain-weave fabric to show all important geometrical parameters used in Pierce's Elliptical Model and Kemp's Race-track Model. (06%)

c) What are the advantages of using the Race Track Model instead of Elliptical Model? (03%)