THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF INDUSTRIAL STUDIES /

BACHELOR OF TECHNOLOGY

FINAL EXAMINATION 2013 / 2014

TTX5232 – YARN AND FABRIC MECHANICS

DURATION - THREE HOURS

DATE: 13th August 2014	TIME: 0930 - 1230HOURS

Total Number of Questions = 08   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 08 carry fifteen (15) marks each.

1. Compulsory Question

    a) Distinguish between "Physical properties" and "Physical characteristics". Give three examples of each from textile materials.   (02 Marks)

    b) Briefly explain how you would determine the crimp of a fibre using load elongation curve.   (03 Marks)

    c) In conventional engineering applications, **stress** (f) is defined as force per unit area (F/A). The **specific stress** (σ) applied to textile fibres is force per linear density (eg. N/tex). Derive an expression to give the relationship between 'f' and 'σ'.   (04 Marks)

    d) Name four type of **fancy** yarn and draw sketches to show their appearance.   (02 Marks)

    e) Briefly explain what you understand by fibre migration in the process of staple yarn manufacture.   (03 Marks)

    f) Briefly explain why subjective or objective measurements of hairiness of staple Yarn are difficult. (give four reasons)   (03 Marks)

    g) State the two Amonton's laws of friction.   (02Marks)

    h) What is the most significant difference between the structures of ring spun and rotor spun yarns?   (02 Marks)

    i) Compare the most important properties/characteristics of common engineering materials with those of textiles.   (02 Marks)

    J) Briefly explain the term crimp height in woven fabric   (02 Marks)

(2) a). Explain the terms "Elastic recovery" and "Work recovery" using a stress-strain curve of an elastic yarn considering elastic and plastic extension. (07 Marks)

b). Explain various time dependent deformation of a fibre, where spontaneous load introduce over a period of time and remove spontaneously. (draw a time extension curve and time load curve to show different creep) (08 Marks)

(3) a). Explain the effect of moisture regain and the temperature of the guide. Draw a graph illustrating the changes of friction with increase of moisture. (07 Marks)

b). Briefly explain the following terminology related to structural features of yarn and the influence of them on physical properties and characteristics.
(08 Marks)

   i. Volumetric density

   ii. Avarage fibre segment length

   iii. mobility or freedom of movement

(4) a). Explain the influence of following factors on yarn hairiness. (05 Marks)

   i. Twist   ii. Fibre Finess

   iii. Fibre length   iv. Fibre Bending

b). Open packing and Hexagonal Close Packed Structure are two models which give how fibres are arranged in the cross section of a yarn. However the way of packing of fibres is different in actual yarns. Discuss the reasons for these deviations from ideal models. (10 Marks)

(5) a) When you developed a model to study the stress strain behavior of yarn, you made certain assumptions. Explain 5 of these assumptions (05 Marks)

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

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

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

b) Draw a typical stress /strain (or load/elongation) curve and explain or define the terms initial modules, yield point, specific tress and work of rupture.
(08 Marks)

c) What is an "Elastomeric Yarn"? (03 Marks)

(7) a) Explain the term "crimp interchange" in woven fabrics under tensile force.
(04 Marks)

b) Yarn parameters and fabric parameters play an important role in ascertaining the fabric geometry of a woven fabric. Briefly explain the above parameters of yarn and fabric. (06 Marks)

c) Derive the relationship between English cotton count and the Text count of spun yarn. (05 Marks)

(8) a) 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 Marks)

b) Briefly explain the elliptical geometry of peirce's used in developing in elliptical theory using a fabric cross-section. Mark the specification such as length displacement, diameters, angle, etc. (no need to develop theory) (07 Marks)