The Open University of Sri Lanka
Faculty of Engineering Technology
Department Of Textile and Apparel Technology

035

Study Programme	: Bachelor of science honors in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: TAX7369 Engineering Aspects of Weaving**
Academic year	: 2023/2024
Date	: 06th February 2025
Time	: 13.30 - 16.30 Hrs
Duration	: 3 hours

General Instructions:

1. Read all instructions carefully before answering the questions.
2. This is a closed book test (CBT).
3. Write your index number on all the pages of the answer script.
4. This question paper consists of **EIGHT (08)** questions across **06** pages.
5. Answer **QUESTION 1 (a to k)**, which is **COMPULSORY**, and **ANY FIVE (05)** questions from Questions 2 to 8. Question 1 is carrying 25 marks, and each of Questions 2 to 8 carries 15 marks.
6. Do not answer the additional questions.
7. Start each question on a new page.
8. Write the numbers of the answered questions on the cover page of the answer book.
9. Write your answers in clear handwriting.
10. Do not use a red pen for writing your answers.

COMPULSORY QUESTION

(Q1)

(a) Calculate the values of the following parameters, if the traverse ratio of the pattern repeat is 2.5: (04 marks)

i. Number of Double Traverses per Repeat,

ii. Number of Diamonds Lengthwise,

iii. Number of Diamonds in circumference and

iv. Number of coils per repeat.

(b) Distinguish between "Random winding "and "Precision winding" employed in the cross-winding process? (02 marks)

(c) What is "Linear gain" related to yarn winding? (02 marks)

(d) Figure 1. Shows a top elevation of yarn coils wound of a closed precision wound structure. Calculate linear gain (g). (Yarn diameter (d) = 0.6 mm, angle of wind (β) = 30°). (02 marks)

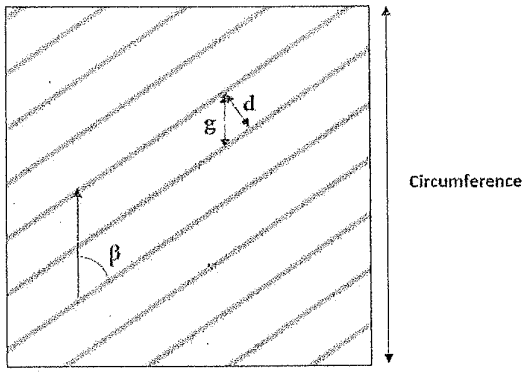


Figure 01.

(e) List down FOUR (04) factors to be considered when locating a weaving mill.

(02 marks)

(f) State FOUR (04) operational factors influencing the productivity of the sectional warping. (02 marks)

(g) Define the following, (02 marks)

I. Sectional warping:

II. Direct warping:

(h) State TWO (02) types of short-term stoppages in a weaving process.

(02 marks)

(i) What do you mean by "Ballistic weft insertion"? Name TWO ballistic weft insertion techniques. (02 marks)

(j) State THREE (03) phases of the flight of a projectile through the warp shed.

(03 marks)

(k) What is "Digi cone winding"? (02 marks)

Answer **QUESTION 1 (a to k)**, which is **COMPULSORY**, and **ANY FIVE (05)** questions from Questions 2 to 8.

(Q2)

Rani weaving mill need to produce weaver's beams with a warp of **2800 m length** and **4000 ends** of **30 tex cotton yarn**. A sectional warper is available for this purpose. The creel capacity of the warping machine is **800**, and each creeling is sufficient for **three beams** and assuming a **2% waste of yarn**. The warping speed of the machine is **450 m/min**, and the beaming speed is **70 m/min**. The processes of warping and beaming have machine stop times due to several reasons:

- It takes **0.5 minutes** to creel a supply package and tie in the end.
- It takes **4 minutes per section** for leasing and moving the traverse.
- On average, **2.5 minutes** are needed to repair a breakage, and the average number of breaks during warping is **4 per 1 million meters of yarn.**
- Preparing the warp for beaming and beam changes requires **10 minutes per beam.**

Calculate the following,

a) Weight of yarn available on each supply package. (04 marks)

b) Total duration of time the warping machine must run to warp all the sections and beam the three weaver's beams. (05 marks)

c) Calculate the total time taken to produce the three weaver's beams and the running efficiency of the warping machine. (06 marks)

(Q3)

A 25 tex cotton warp containing 3500 ends has 10% size added. In each kilogram of size paste, there are 75 g of solid ingredients (oven-dry mass). Consider 1 km of warp fed to the size box has a moisture regain of 9%.

(a) Calculate the mass of size paste to be taken up from the size box. (09 marks)

(b) Discuss how size take-up is influenced by concentration, viscosity and the temperature of the size box. (06 marks)

(Q4)

(a) Briefly explain FOUR (04) approaches that can be used to control different costs in a weaving mill. (08 marks)

(b) A woven fabric with the following specifications is to be produced. Determine the selling price of one meter (1 m) of the fabric. Clearly mention all the steps you followed to calculate it. (07 marks)

- Total production/conversion cost of the fabric/meter = Rs.57.00
- Annual production - 5 million
- Profit margin - 16%
- Warp consumption per 5 million - 800,000 kg
- Weft consumption per 5 million - 500,000 kg
- Selvedge yarn consumption - 100,000 kg
- Total yarn consumption - 14,000,000 kg
- Yarn price per kg - Rs. 350.00

(Q5)

(a) Discuss the importance of maintaining the required dimensions of the warp shed. (05 marks)

(b) Figure 02. shows a symmetric shed. Examine how the shed geometry parameters affect the elongation and frictional stroke of warp yarns during weaving. Derive the relevant equations to support your answer and discuss how they influence warp yarn stresses and overall fabric quality. (10 marks)

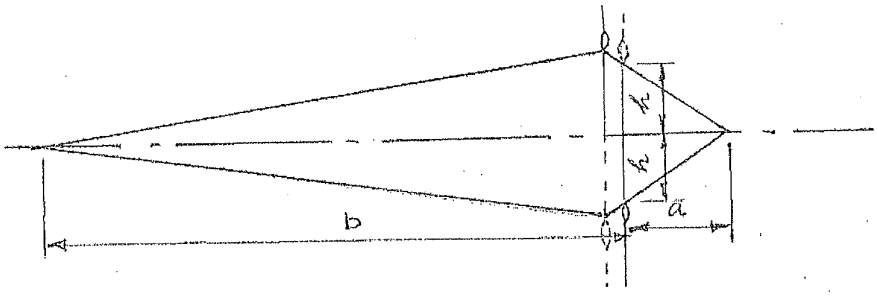


Figure 02.

(Q6)

(a) Explain why the timing of the head frame leveling is important for efficient shuttle picking in a weaving machine. Use a suitable diagram to support your explanation.
(05 marks)

(b) The reed width (L) of a shuttle loom is 150 cm. The distances (a_1 and a_2) between the two extremes of the reed and the shuttle boxes are 7 cm each. The length (l) of the shuttle is 40 cm, and the mass of the shuttle with the full pirn is 800 g. The weft insertion must be completed over a crankshaft rotation of 130°. If the machine runs at 200 rpm:

I. Calculate the average velocity the shuttle must achieve to complete the flight.
(05 marks)

II. Refer to figure. 03 and calculate the force (F) applied by the picker. Assuming the force applied by the picker acts over a distance of 25 cm, Consider the coefficient of friction (μ) between the shuttle and shuttle box walls to be 0.35 and the force exerted by the swell on the shuttle to be 12 N.
(05 marks)

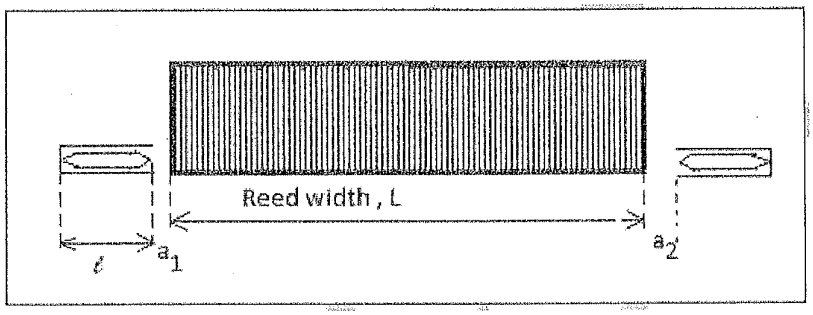


Figure 03.

(Q7)

(a) Discuss the different forces acting on the weft yarn during its withdrawal from a drum accumulator and a loop accumulator. Compare how these forces influence weft insertion efficiency in air-jet weaving. (08 marks)

(b) Explain the relationship between yarn characteristics (e.g., count, twist, and hairiness) and their influence on weft insertion behavior in air-jet weaving. How do these properties impact tractive forces and air consumption?

(07 marks)

(Q8)

Discuss THREE (03) of the following topics. (15 marks)

I. Role of weft accumulators in modern weaving.
(Discuss the function of weft accumulators in reducing tension, ensuring uniform withdrawal rates, and minimizing the influence of package-related factors.)

II. Importance of beat-up force and cloth fell position. (Explain the interplay between beat-up force, cloth fell positioning, and pick spacing. Discuss the implications of variation on fabric quality and defect occurrence.)

III. Mathematical modeling of weft insertion forces
(Summarize the mathematical equations governing forces during air-jet weft insertion, such as frictional drag and body resistance, and their practical applications in weaving.

IV. Discuss the Importance of beat-up force and cloth fell position (Explain the interplay between beat-up force, cloth fell positioning, and pick spacing.