

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



0048

Study Programme : Bachelor of Science Honours in Engineering/Bachelor of Industrial Studies Honours
Name of the Examination : Final Examination
Course Code and Title : TAX4560 – Woven Fabric Technology
Academic Year : 2024/25
Date : 23rd February 2026
Time : 13.30 – 16:30 Hours
Duration : 3 hours

General instructions

1. Read all the 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 Seven (07) pages.
 5. Answer the **QUESTION 01** (a to f), which is **COMPULSORY**, and **ANY FIVE (05)** questions from the Questions 02 to 08. The Question 1 carries 25 marks, and each of the Questions 2 to 8 carries 15 marks.
 6. Do not answer any 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

Question 01

- a) What are the two main objectives of the winding process in weaving preparation, and why is yarn clearing important? (04 marks)
- b) Briefly explain why side withdrawal is necessary for yarn packages with flanges. (03 marks)
- c) List down four (04) different types of creel designs developed to reduce creeling time in the warping process. (04 marks)
- d) What is warp sizing, and what are the main objectives of applying size to warp yarns? (05 marks)
- e) Explain the action of beat-up in weaving? (04 marks)
- f) State any five (05) auxiliary motions of weaving and briefly state their functions. (05 marks)

Answer ANY FIVE (05) questions from the following Seven (07) Questions.

Question 02

A cotton school uniform fabric is to be plain woven. The construction details of the finished fabric are as given below:

Fabric Construction (Finished State):

$$\frac{\text{Cotton 30 tex} \times \text{Cotton 25 tex}}{120 \text{ EPI} \times 80 \text{ PPI}} \times 60 \text{ inches}$$

It is also provided that warp crimp (C1) = 8%, weft crimp (C2) = 12% and waste during yarn preparation: 3% for warp yarn and 2% for weft yarn. (Hint: 1 yard = 0.9144 m)

- a) Calculate the **weight of warp yarn** in kilograms required to weave the fabric, including 3% waste. (07 marks)
- b) Calculate the **weight of weft yarn** in kilograms required for weaving, including 2% waste. (08 marks)

- a) Figure 01. shows a winding mechanism. Briefly describe the two motions involved in the winding process that ensure even distribution of yarn on a cone or tube.

(03 marks)

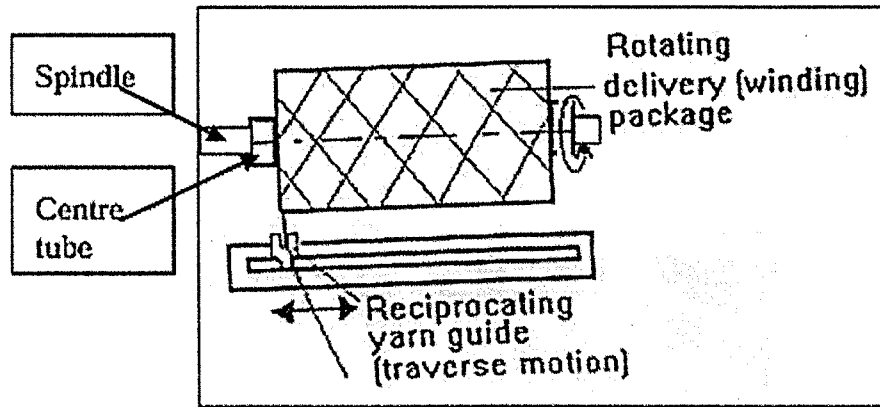


Figure 01.

- b) In a direct spindle drive system with variable speed (Figure 02.), the surface speed of the yarn package is maintained constant throughout the winding process.

(05 marks)

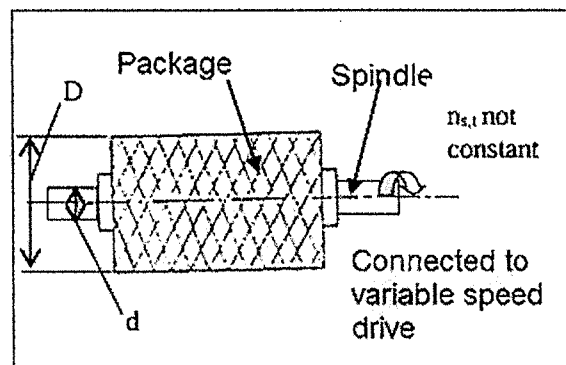


Figure 02.

Where,

- $n_{s,0}$ = spindle speed at the beginning of winding
- $n_{s,t}$ = spindle speed at package diameter D
- d = diameter of empty tube
- D = package diameter at time t

Derive a mathematical expression to give the relationship between spindle speed (n_s) and package diameter $\times (D)$ for a constant surface speed.

c) A winding machine operates using a direct spindle drive with variable speed to maintain constant surface speed. Diameter of empty tube, $d=40$ mm, Initial spindle speed, $n_{s,0}=1500$ rpm, Package diameter after winding, $D=160$ mm. Assuming the surface speed remains constant throughout the winding process:

I. Calculate the spindle speed $n_{s,t}$ when the package diameter reaches 160 mm. (04 marks)

II. Determine the surface speed of the package (in m/min). (03 marks)

Question 04

a) Briefly explain the two stages of sectional warping, and why special warping drums are needed when winding multiple sections? (04 marks)

b) A weaver has an order for 25,000 m of a plain-woven fabric with the following specifications:

$$\frac{\text{Cotton 45s} \times \text{Cotton 45s}}{117 \text{ EPI} \times 76 \text{ PPI}} \times 54 \text{ inches}$$

Warp crimp = 6%, Weft crimp = 7%, Waste percentage for warp yarn = 4% and Creel capacity = 750 spindles. Calculate the following.

I. Calculate the exact number of ends required per back beam if the weaver is provided with a direct warper (04 marks)

II. Calculate the total length of warp yarn required (in yards). (03 marks)

III. Calculate the weight of yarn required per package. (04 marks)

Question 05

- a) What are the main causes of warp yarn breakages during the weaving process? (06 marks)
- b) What are the main ingredients of a size mixture? Discuss how these main ingredients are contributing to maintaining the properties and characteristics of the size coating to achieve the objectives of sizing. (09 marks)

Question 06

Figure 03. Shows a loom driving mechanism of a weaving machine.

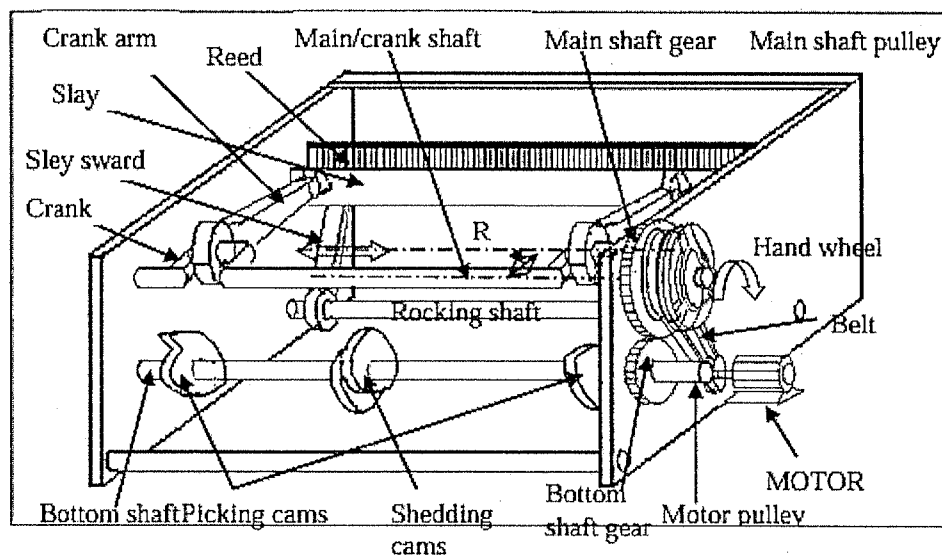


Figure 03.

- a) Explain the roles of the **main crank shaft, crank arms, and rocking shaft** found in the driving mechanism of a conventional loom. In your answer, discuss the following:
- How power from the motor is transmitted to the crank shaft.
 - How the rotation of the crank shaft causes the forward and backward movement of the sley.
 - The significance of the crank radius (R) in controlling sley motion.

(08 marks)

b) Discuss the **function of the bottom shaft** in a conventional loom. In your answer, include:

- How the bottom shaft is driven by the crank shaft and the importance of the gear ratio.
- The function of picking cams/tappets and how they propel the shuttle across the shed.
- The role of the shedding cams on the bottom shaft in generating the warp shed for weaving.
- How the bottom shaft coordinates picking and shedding to ensure smooth weaving.

(07 marks)

Question 07

- a) Draw a linear timing diagram for a loom where the crankshaft completes one full rotation from 0° to 360° . The reed starts at the cloth fell (0 mm, right after beat-up is completed) moves to a maximum displacement of 275 mm, and then returns. The heald frames move in opposite directions with a maximum displacement of ± 200 mm each, crossing at 0° when the shed closes. Additionally, indicate the best time for shuttle flight in the diagram. (05 marks)
- b) State three (03) factors affecting the time required for the flight of the shuttle in a shuttle loom? (04 marks)
- c) Draw the circular timing cycle for the following settings of a weaving machine. Beat-up takes place at 0° , Shed closed (Heald levelling) at 350° , Shed is dwelling over 150° , Shed is opening from 350° to 105° , Shed is closing from 255° to 350° . (06 marks)

Question 08

- a) Define a cam and explain the working principle of a cam mechanism with considering the cam profile. (05 marks)
- b) Explain the difference between positive cams and negative cams. (05 marks)
- c) With providing proper illustration explain the working principle of negative cam shedding with roller reverse mechanism. (05 marks)