

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



Study Programme	: Bachelor of Science of Engineering Honours Bachelor of Industrial Studies Honours
Name of the Examination	: Final Examination
Course Code and Title	: TAX4560 - Woven Fabric Technology
Academic year	: 2023/2024
Date	: 10th February 2025
Time	: 09:30-12:30 Hrs.
Duration	: 3 hours

General Instructions:

1. Read all instruction carefully before answering the questions.
2. This is a closed book test (CBT).
3. Write down your index number in all the pages of answer scripts.
4. This question paper consists of eight (08) questions in six (06) pages.
5. Answer the **question one (Q1), which is compulsory and any five (05) questions from Question 02 to 08**. Question one (Q1) carries 25 marks and questions two (Q2) to eight (Q8) carry 15 marks each.
6. Do not answer more than six questions.
7. Answers for each question should commence from a new page.
8. Write down the answered question numbers in the cover page of the answer book.
9. Answers should be in clear handwriting.
10. Do not use red colour pens to write the answers.

Compulsory question

(Q1)

- a) State THREE (03) reasons why textile yarns produced by spinning cannot be directly used for weaving? (03 marks)
- b) What is crimp in woven fabrics, and state FOUR (04) factors influence the crimp of warp and weft yarns? (03 marks)
- c) Briefly explain why winding is essential for economical yarn processing in fabric formation. (02 marks)
- d) Explain the basic process of yarn winding? (02 marks)
- e) State the two stages of sectional warping, and explain, how do different types of warping drums used in different sectional warping methods help prevent overlapping of warp sections during the process? (03 marks)
- f) Name FOUR (04) different types of warping creel design available for warping. (02 marks)
- g) State THREE (03) factors influence the time required for shuttle flight in shuttle looms. (02 marks)
- h) State the key difference between "closed shed" and "open shed" formation in shuttle looms? (02 marks)
- i) Briefly explain the basic principle of projectile weft insertion method. (02 marks)
- j) List down FOUR (04) different methods used for sizing of warp yarns. (02 marks)
- k) An air jet loom having a nominal reed width of 200 cm is processing a polyester fabric with a reed-in-width of 180 cm at a speed of 1300 picks per minute (PPM). Calculate the nominal and working weft insertion rates of the machine. (02 marks)

Answer any five (05) questions from Question 02 to 08

(Q2)

A piece of woven fabric has a length (warp way) of 90 cm and a width (weft way) of 110 cm. The uncrimped lengths of the yarns removed from the fabric are measured as 95 cm for the warp and 120 cm for the weft. The fabric is made with warp yarns of 0.2 mm diameter and weft yarns of 0.15 mm diameter, with a warp density of 50 ends/cm and a weft density of 40 picks/cm. Based on these specifications,

- (a) Calculate the crimp percentages ($C_1\%$ and $C_2\%$) for the warp and weft yarns and the crimp factors for the warp and weft yarns. (04 marks)
- (b) Calculate, the fractional cover of the warp, fractional cover of the weft and cloth cover factor. (06 marks)
- (c) A weaving mill is tasked with producing 1000 yards of a fabric with a width of 48 inches and a warp density of 40 ends per inch (EPI). The warp crimp ($C_1\%$) is 6.5%, and the English Cotton Count (Ne_1) of the warp yarn is 30. Assume a waste percentage of 3%, for warp yarn. Calculate the weight of the warp yarn required to weave the fabric. (05 marks)

(Q3)

- (a) Briefly explain the structure and formation of the following yarn packages: (05 marks)
 - I. Ring Bobbin
 - II. Flyer Package
 - III. Cheese package
- (b) Describe the differences between parallel and cross-wound packages in terms of yarn arrangement, stability, and packing density. Discuss why flanges are necessary for parallel wound packages but not for cross-wound packages. (05 marks)
- (c) Explain the two main motions involved in the winding process. Use a relevant, labelled diagram to support your answer. (05 marks)

(Q4)

- (a) What is sizing as used in the weaving process? State FOUR (04) major objectives of sizing warp yarns. (04 marks)
- (b) Discuss what are the main ingredients used in size mixtures and explain their functions. (08 marks)
- (c) What are the advantages and disadvantages of single yarn sizing compared to conventional beam sizing? (03 marks)

(Q5)

- (a) Figure 01. shows a loom driving mechanism. Explain the function of the Main Crank Shaft, Rocking Shaft, and Bottom Shaft in the loom driving mechanism. How do these shafts coordinate to perform the primary motions of weaving: shedding, picking, and beat-up? (05 marks)

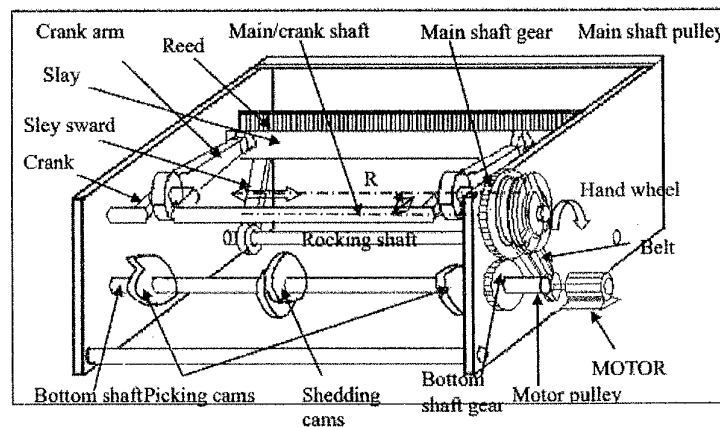


Figure 01.

- (b) 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), 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. Assume sinusoidal movements for reed and both heald frames. (05 marks)
- (c) In a weaving machine with a symmetric shed, the distance between the heald frame and the fell of the cloth (B) is 50 cm. The angle of inclination for both the top shed and bottom shed (β) is 8° , ensuring equal shed opening. Distance from the reed to the cloth fell (b) is 4 cm. The system follows symmetric conditions (Figure 02), where: (05 marks)

- $H_1 = H_2 = H$ (Equal shed opening at the heald frame)
- $\beta_1 = \beta_2 = \beta$ (Equal inclination angles)
- $h_1 = h_2 = h$ (Equal shed heights at the reed)

By using relevant formulas, calculate the following:

- The height of the shed at the heald frame (H)
- The height at the reed (h)
- The total height of the shed at the reed ($h_1 + h_2$)

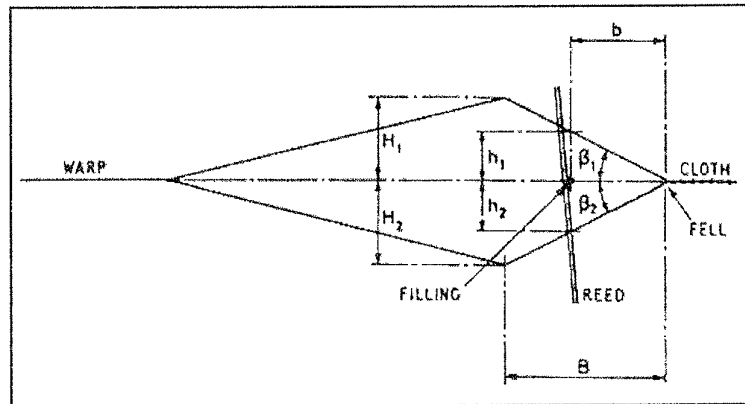


Figure 02.

(Q6)

- (a) Figure 03. shows a crank shedding mechanism. Explain the principle of the crank mechanism used in the shedding motion of weaving machines.

(06 marks)

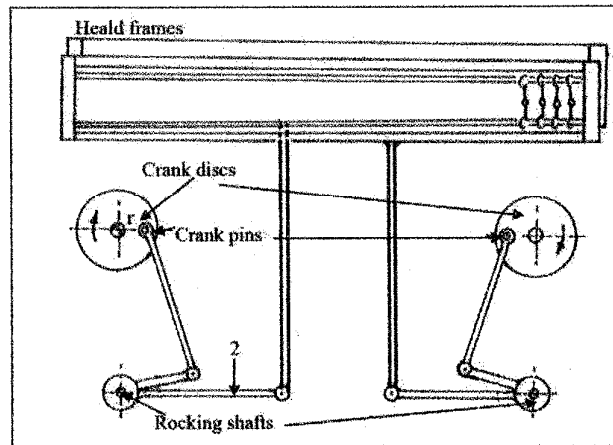


Figure 03.

(b) Explain why crank shedding mechanisms are suitable only for plain weave and weft rib fabrics? (05 marks)

(c) Briefly state the advantages and disadvantages of crank shedding mechanisms in weaving. (04 marks)

(Q7)

(a) Briefly explain the operational sequence of weft insertion using multiple projectiles (Figure 04), including the role of each component involved in the process? (05 marks)

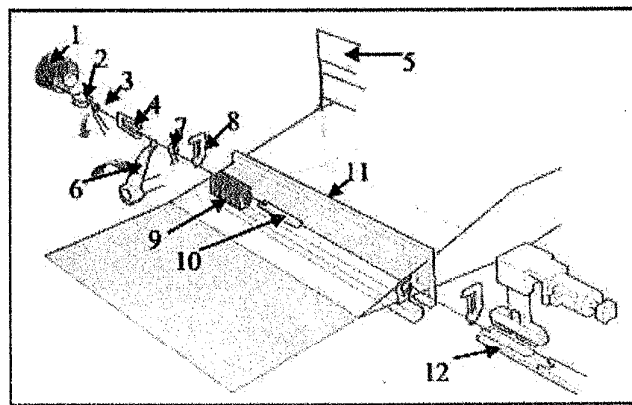


Figure 04.

(b) Explain the TWO (02) main categories of shuttle picking mechanisms and highlight the differences between them. (05 marks)

(c) Explain the major objective of shuttle checking and briefly state what problems can occur if the braking force is either too high or too weak? (05 marks)

(Q8)

Write short notes on TWO (02) of the following topics. (15 marks)

(a) Compare and contrast rigid and flexible rapiers based on their design, functionality, and machine requirements.

(b) Basic principle of air jet weft insertion technique in weaving.

(c) The operational principle and advantages of the water jet weft insertion method in weaving.