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

039

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: TAX7369 Engineering Aspects of Weaving**
Academic Year	: 2021/22
Date	: 15th February 2023
Time	: 1330-1630hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions 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 paper consists of two parts, namely A & B in 06 pages. Part A consists of six (06) questions. This section is compulsory, and the marks allocated for Part A is 20.
5. Part B consists of Six (06) questions. Answer only five (05) questions. Each question carries 16 marks . The marks allocated for Part B is 80.
6. Answers for each question should commence from a new page. If a question has many parts, all the parts should be answered in the chronological order under the same question.
7. Write down the answered question numbers in the cover page of the answer book.
8. Answers should be in clear handwriting.
9. Do not use red-colored pens to write the answers.
10. The conversion of imperial units to metric units, which are necessary in this examination paper are given below.

Imperial Unit	Metric Equivalent
1 inch	2.54 cm
1 yard	0.91 m
1 pound	0.46 kg
1 radian	60 °

Part (A)

(Q1). Briefly explain the purpose of having "heald wires/heddles" of different shapes, giving two (02) examples.

(05 marks)

(Q2). State two (02) advantages of the rapier weaving over conventional shuttle weaving method.

(02 marks)

(Q3). Briefly explain two (02) advantages of electronic cloth-take up mechanisms of weaving looms.

(04 marks)

(Q4). State two (02) properties of a good quality fabric selvedge.

(02 marks)

(Q5). Briefly explain why conventional lever and cam dobbies cannot be operated at high speeds, in comparison to modern rotary dobbies.

(03 marks)

Q6). Briefly explain two (02) woven fabric defects caused by temples.

(04 marks)

Part (B)

Q7).

(a) Differentiate between "Machine running efficiency" and "Mill efficiency".

(04 marks)

(b) Write an essay on **"Multi Phase Looms"**, explaining the reasons leading to the development of these looms, different types of multi-phase looms, problems associated with different types of looms and present state of multi-phase weaving.

(12 marks)

Please turn over...

Q8).

(a) Briefly explain why "Grey Fabric width" is always less than "Reed-in width".

(04 marks)

(b) A fabric is produced using the machine settings given below.

Reed width	100 cm
Loom speed	160 picks/ min
Loom efficiency	80%
Warp count	22 tex
Weft count	24 tex
Warp crimp	5%
Weft crimp	7%
Warp density	20 ends/cm
Weft density	15 picks/cm

Calculate the following for a production period of **40 hours.**

i. Number of picks inserted.
ii. Length of loom state / grey cloth produced in meters (m).
iii. Loom production in square meters (m^2) of fabrics.
iv. Loom production in kilograms (kg).

(09 marks)

(c) Briefly explain three (03) factors on which the number of weaving machines allocated to an operator depends on.

(03 marks)

Q9).

(a) Briefly explain why it is necessary to avoid bouncing back of the shuttle during shuttle checking. (04 marks)

(b) **"The forces applied on the shuttle during checking are very decisive when the lifetime of a shuttle is considered."** Discuss the above statement using your knowledge on the process of shuttle checking.

(06 marks)

Please turn over...

(c) The torsion rods used in the picking mechanism of a Sulzer loom of 330 cm reed width have the following dimensions.

- Diameter is 0.59 inches (0.59 x 2.54 /100 m)
- Twisting length is 28.4 inches (28.4 x 2.54/100 m)
- Angular displacement of the torsion rod, θ at the beginning of picking= 28°
- The modulus of rigidity of steel is 80 GPa.

Calculate the amount of energy which can be stored in the rod when it is twisted at 28°.

(03 marks)

(d) Only a part of the energy calculated in part (c) will be effectively transferred to the projectile. Briefly explain what happens to the rest of the dissipated energy.

(03 marks)

Q10).

(a) Briefly explain two (02) factors to be considered when locating a weaving mill.

(04 marks)

(b) Cotton 3/1 twill fabrics are required to be produced to be distributed as school uniforms materials for the year 2024. The production is to be done as an annual project starting on January 1st 2023 with a forecasted production of 5 million meters by the end of 31st December 2023. The construction details of the material are as follows.

Warp Yarn	Cotton 21s
Weft Yarn	Cotton 21s
Warp Density	116 ends / inch
Weft Density	60 picks / inch
Grey Fabric Width	45 inches

Air jet looms, with cam shedding consisting of a 150 cm (60") reed width, are expected to be used for this purpose. The loom operational specifications are as follows.

- Speed of the loom is 850 rpm & average efficiency is 90%.

The operation hours are as follows.

- 8 hours per shift, 3 shifts/day and 300 days per year, which results in 7200 hours per year.

Please turn over...

i. Calculate the number of looms that are required to meet the forecasted fabric demand. (03 marks)

ii. Assuming a warp crimp factor of 4% and a weft crimp factor of 7%, calculate the projected warp and weft yarn consumption for the expected fabric demand. Consider that 1 hank is 594m for your calculations.

(04 marks)

iii. If the selvedge consists of 0.3% of the fabric width, calculate the selvedge waste.

(02 marks)

iv. If a size percentage of 12% is applied to the warp yarn of the produced fabric, calculate the total sizing material cost of the production, assuming that the cost of sizing is Rs.80/= per warp yarn kg.

(03 marks)

Q11).

(a) Calculate the "Total distance walked by an operator per hour in the production line" using the following particulars, clearly stating all steps used in the calculation.

Type of Stoppage	Frequency (hour/machine)	Average repair time (min)
Weft Breakages	0.5	0.50
Warp Breakages	1.5	1.00
Slack & entangled yarns	0.1	0.75
Other problems	0.1	0.50

Assume that an operator spends 35 minutes per hour to attend servicing work (repairing yarn breakages, supplying weft packages etc.) and 15 minutes for walking between machines for inspection and other 10 minutes for relaxation and personal needs. Assume that the time needed to move from one machine to the next is 5 seconds, and the average distance between the machines is 4m.

**Note that the time needed to move from one machine to another is included in the time taken for walking between machines for inspection.

(07 marks)

Please turn over...

(b)Write a descriptive note comparing the cost of weaving in shuttle-less looms and shuttle looms. (05 marks)

(c) Briefly explain how patterning occurs in random winding.

(04 marks)

Q12).

(a) Discuss why tension should be applied to the warp yarns and explain the different mechanisms that are used for this purpose.

(05 marks)

(b) Briefly explain how shed geometry would affect the dynamic warp yarn tension.

(06 marks)

(c) **"Actual warp tension curves may differ from the theoretically derived curves."** Briefly discuss whether you agree/disagree with this statement, using at least three (03) reasons to justify your answer.

(05 marks)

- *The End* -