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

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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	: 2022/23
Date	: 15 February 2024
Time	: 13:30-16:30 Hrs

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Eight (8)** questions in **Six (6)** pages.
3. Write down your Index Number in all the pages of answer scripts.
4. Answer the question one (Q1), which is compulsory and five (05) more questions from Q2 to Q8. Question one (Q1) carries 30 marks and questions two (Q2) to eight (Q8) carry fifteen (14) marks each.
5. Answers to each question should commence on a new page. If a question has many parts, all the parts should be answered in the chronological order under the same question.
6. Write down the answered question numbers in the answer book.
7. Answers should be in clear hand writing.
8. Do not use red colour pens to write the answers.

Compulsory Question

(Q1) (a) What does the weft insertion rate measure, and how is it expressed? (02 marks)

(b) Define theoretical loom output and actual loom output. How are they calculated? (02 marks)

(c) Explain the distinction between overall efficiency and mill efficiency, and show why it's important to consider short-term stoppages. (02 marks)

(d) Briefly explain three ways to improve loom efficiency in a weaving operation. (06 marks)

(e) What is machine interference, and how does it impact machine allocation? (04 marks)

(f) Define the maximum operative productivity and discuss its relevance to weaving. (04 marks)

(g) Why semi-automatic m/c tend to have lower productivity compared to ideal automatic m/c? (04 marks)

(h) Explain how the quality of yarn and environmental conditions influence loom efficiency. (06 marks)

Answer any five (05) questions from the following seven (07) questions

(Q2) (a) 100 kg oven dry warp yarns were sized to the add-on of 8% and dried to overall (yarn and dry size) moisture content of 10%. Calculate the final mass of the sized yarns. (02 marks)

(b) A lot of 20 kg cotton warp, having moisture regain of 8.5%, is sized with a paste of 15% concentration. If 10% add-on the oven dry weight of the yarn is aimed then what should be the wet pick-up? How much water has to be evaporated so as to leave 8% moisture regain in the sized warp ? (03 marks)

(c) 40 tex cotton yarn has add-on of 8%. If the moisture regain of the warp is 10% then determine the oven-dry mass of the size added per kg of the unsized warp. (03 marks)

(d) The stretch in a sizing machine processing acrylic warp yarn is 1%, 3% and 2% in the creel zone, sizing zone and drying zone respectively. If the warp crimp in the woven fabric is 10% then determine the length of fabric that could be produced from 1000 m length warp sheet in each of the warper's beam. (03 marks)

(e) A sizing machine is running at 150 m/min with 6000 ends. The add-on requirement is 12% and concentration of the size paste is 18%. If yarn count is 20 tex (without any moisture) and residual moisture content in the sized yarn and film after drying is 10%, then calculate the number of drying cylinder required. One drying cylinder can evaporate 4 kg water per min. (03 marks)

(Q3) (a) The length of a fabric is 10 m. The length of a warp yarn, removed from the fabric, in straight condition is 10.8 m. Determine the crimp% in warp direction. What should be contraction %? (02 marks)

(b) Prove that for cotton yarn with packing factor of 0.6, $\text{diameter (inch)} = \frac{1}{28\sqrt{Ne}}$ (03 marks)

(c) A cotton fabric is made from 20 Ne warp and ends per inch is 50. Determine the warp cover factor. (03 marks)

(d) Show that the expression for fabric cover facto r is , $K_1 + K_2 - \frac{K_1 K_2}{28}$ where K_1 is warp cover factor and K_2 is weft cover factor. (03 marks)

(e) Calculate the mass of warp and weft in oz/ yd^2 and the mass of fabric (oz/yd^2) for the following cotton cloth: 22s × 18s; 64 epi × 40 ppi ; 6.5% × 8.5% . (03 marks)

(Q4) (a) Advanced Production Capacity Calculation - The weaving factory has 40 air jet looms with a production efficiency of 92%. If each loom produces 20.5 meters per hour, calculate the total annual fabric production assuming the factory operates for 7200 hours per year. (02 marks)

(b) Cost of Sizing Ingredients - The cost of sizing ingredients per kg is Rs 95. Calculate the total cost for sizing ingredients for a production of 7 million meters, given a sizing percentage of 10% (warp yarn consumption + selvedge yarn consumption). (03 marks)

(c) Labour Cost and Benefits - In a weaving factory, the monthly wage for a weaver is Rs 28,000, and the EPF contribution by the employer is 8% of the salary. Calculate the total annual labour cost for weavers ,considering 12 weavers working for 12 months. (03 marks)

(d) Power Consumption and Cost - A weaving factory consumes 450 kW of power annually. If the cost of electricity is Rs 12 per kWh, calculate the total annual power cost for the factory. (03 marks)

(e) Depreciation and Interest - The weaving factory has invested Rs 35,000,000 in machinery and equipment. Calculate the yearly depreciation for machinery considering a depreciation rate of 10%, and calculate the annual interest cost at an interest rate of 9%. (03 marks)

(Q5) (a) Calculate the average shuttle velocity from the following particulars: (02 marks)

Width of warp in reed = 1.2 m

Effective length of shuttle = 30 cm

Loom speed = 240 picks/min

Degree of crank shaft rotation available for the passage of shuttle = 140°

(b) Calculate the loom speed and weft insertion rate of a loom if the average velocity of shuttle = 50 km/h, degree of crank shaft rotation available for the passage of shuttle across the shed = 135°, shuttle length = 40 cm, width of warp in reed = 2 m. (02 marks)

(c) Calculate the power required for picking from the following particulars: (02 marks)

Width of warp in reed = 1.5 m

Effective length of shuttle = 32 cm

Loom speed = 224 picks/min, Shuttle mass = 500 g

Shuttle enters in the shed at 110°, Shuttle leaves the shed at 245°

(d) Calculate the power requirement for picking and work done per pick from the following parameters: (02 marks)

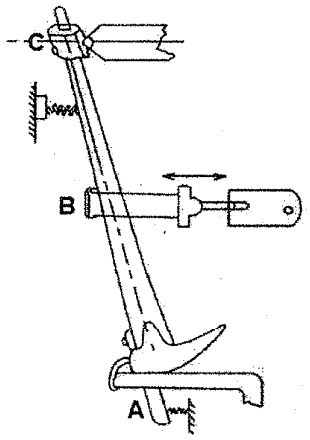
Shuttle mass: 0.5 kg

Reed width: 1.5 m

Shuttle length: 0.25 m

Loom speed: 200 PPM, Degree of crank shaft rotation for passage of shuttle: 120

(e) A shuttle of 500 g mass is uniformly accelerated by the picker of a cone under-pick system. The length of the picking stroke is 15 cm. The final velocity of the shuttle is 15 m/s. If AB: BC=1:1(Figure) then calculate the force acting on the picking strap (lug strap). (06 marks)



(Q6) Write short notes on any two (02) of the below topics.

i) The effect of cloth fell position and beat-up force of a loom on the weft sett of the fabric. (07 marks)

ii) Advantages of direct warping over sectional warping. (07 marks)

iii) Digi Cone winding. (07 marks)

(Q7) (a) Define a feasibility study in the context of establishing a weaving factory. (02 marks)

(b) Why is it necessary to conduct a feasibility study before investing in a new weaving factory? (02 marks)

(c) Discuss the key areas that a feasibility study for a weaving factory needs to focus on .What are the primary factors to be considered under market issues in a feasibility study? (05 marks)

(d) Explain the significance of technological and organizational requirements in assessing the feasibility of a weaving factory. (05 marks)

Q(8) (a) Yarn waste plays a role in comparing the overall cost of shuttle weaving and shuttle-less weaving

i) Explain how yarn waste is generated and calculated in shuttle and shuttle-less looms. (03 marks)

ii) Discuss the economic impact of the different yarn waste levels between these two types of looms. (04 marks)

(b) The maintenance and running costs of shuttle and shuttle-less looms highlight the differences and their impact on the weaving process.

i) Discuss the factors that influence maintenance costs for both types of looms. (03 marks)

ii) Explain how a textile mill's overall productivity and efficiency can be affected by differences in maintenance costs (04 marks)