

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



Study Programme/s : Bachelor of Science in Engineering Honours
Bachelor of Industrial Studies Honours
Name of the Examination : Final Examination
Course Code and Title : **TAX6454 Technical Textiles**
Academic Year : 2023/2024
Date : 22nd February 2025
Time : 1330 – 1630 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 question paper consists of Eight (08) questions in five (05) pages.
 5. Answer five (05) questions only. Each question carries 20 marks.
 6. Do not write answers to additional questions.
 7. 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.
 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.
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- Q1. (a) How does the Textile Institute – UK define 'Technical Textiles'? (03 marks)
- (b) Messe Frankfurt, the sponsor of Techtextil, the international trade show for technical textiles, has broken the industry into twelve (12) segments. List these twelve segments and give a product example for each of the segments. (12 marks)
- (c) Biomedical textiles are textile products and constructions, that are used for medical and biological applications. These textiles and textile products have been divided into five major categories.
- What are these five categories?
 - Give a product example for each of these five categories.
- (05 marks)
- Q2. (a) What is the primary requirement that is expected of a 'Textile Structural Composite'? (04 marks)
- (b) What do you understand by 'Textile Composite Preforms'? (04 marks)
- (c) Briefly explain the difference between thermoplastic resins and thermosetting resins, with reference to how they behave due to heat and chemicals. (04 marks)
- (d) The primary functions of the resin system in a textile composite are to provide rigidity and to hold the textile reinforcement materials in a prescribed suspension, position or orientation in the composite. For this purpose, any resin system used in a composite material will require certain properties. Name these properties and briefly state what is expected under each of these properties. (08 marks)

- Q3. (a) Fibre-reinforced composites with the best mechanical properties are achieved with continuous fibre reinforcement. There are several methods available for manufacturing these types of composites. Name these methods and list the advantages and disadvantages of each of these different methods. (12 marks)
- (b) Wet Lay Up and Vacuum Bagging are two manufacturing methods that can be used to manufacture, fabric reinforced composites. With the help of suitable diagrams explain the principle behind these two manufacturing methods. (08 marks)
- Q4. (a) Briefly explain the three main requirements a geosynthetic must possess for it to be used in reinforcement application. (06 marks)
- (b) Filtration is one of the key functions performed by geotextiles. What are the two main objectives achieved by using a geotextile as filtration medium? (04 marks)
- (c) In general, what are the four environments where a geotextile filter is required? (06 marks)
- (d) Geotextiles have two important hydraulic characteristics. The ability to transport water across the fabric, and the ability to transport water along the fabric. Briefly explain which type of fabrics are most suitable to perform these hydraulic functions expected of a geotextile. (04 marks)
- Q5. (a) Geotextiles are commonly used for separation when used beneath roadway pavement sections. With the help of a suitable diagram explain the role played by the geotextile as a separator in the road sub-base sub-grade interface. (08 marks)
- (b) There are three different preventive measures that are taken to control erosion due to rainfall runoff. They are sediment traps, vegetable stabilization and sub-soil drainage. Briefly explain how geotextiles could be effectively used in each of these three applications. (12 marks)

- Q6. (a) In the application of automotive textiles, Cut Resistant Polyester fibres are expressly engineered to provide protection against cutting hazards. With the help of a diagram explain how this property is imparted to the polyester fibre. (05 marks)
- (b) Textiles have become now the most widely used material in vehicle seat covering in place of polyurethane foam. Briefly explain the main reasons for textiles replacing polyurethane in this application. (05 marks)
- (c) Over the years, many fibres such as rayon, nylon, polyester and steel cords have been used as reinforcements in vehicle tyres. What are the advantages and limitations of each of these fibres? (05 marks)
- (d) Fibre reinforced composites are increasingly used in aircraft manufacture. What are the major advantages that fibre reinforced composites provide over traditional materials in the manufacture of aircrafts? (05 marks)
- Q7. (a) Clothing provides a microclimate around the body by regulating heat and mass (moisture) interchange between body and the environment. State the physical quantities that are controlled by the clothing and the mechanisms behind this control for each of the physical quantities, you have stated. (07 marks)
- (b) A material to be used in the manufacture of chemical protective clothing should have adequate resistance to permeation by liquids and gases. Briefly explain the steps involved in permeation of liquid or gas through a clothing material including the factors that affect the rate of permeation. (07 marks)
- (c) In determining the propensity to biohazards from causative pathogenic micro-organisms, it is important to consider the microbiology of skin-clothing interface. In this respect, the first factor to be considered is adhesion of micro-organisms to fibrous substrates. Briefly explain the four features or parameters that are relevant for adhesion to fibrous substrates. (06 marks)

- Q8: (a) Aramid fibres used in technical applications fall into two categories: para-aramid and meta-aramid.
- i. What is the difference between these two types of aramid fibres?
 - ii. Give one commercial example each for the two types of aramid fibres.
 - iii. Give one application each for the two types of aramid fibres.

(06 marks)

- (b) The most extensively used method of manufacturing carbon fibres is the conversion of polyacrylonitrile (PAN) to carbon. Draw a flowchart along with the important details, where applicable, to show the main steps involved in the manufacture of carbon fibres from PAN. (07 marks)
- (c) The basic theory of producing a super-strong fibre such as Dyneema or Spectra (both trade names), from polyethylene is based on achieving a very high level of macromolecular orientation. Name the method of producing these super strong fibres and give the important steps involved in this process. (07 marks)