



**M.TECH DEGREE EXAMINATIONS: NOV/ DEC 2024**

(Regulation 2024)

First Semester

**TECHNICAL TEXTILE**

24TXT504: Theory of 3-D Fibrous Assemblies

**COURSE OUTCOMES**

- CO1:** Analyze the concepts of 3D fibrous assemblies to understand their structure and application in technical textiles.
- CO2:** Evaluate the manufacturing techniques and properties of 3D woven fabrics to recommend suitable applications.
- CO3:** Compare the structure and behavior of multiaxial warp-knitted fabrics to assess their advantages and applications.
- CO4:** Create 3D braided and nonwoven structures to explore their potential uses in technical textiles.
- CO5:** Apply innovative applications of 3D fibrous assemblies in various technical textile fields to enhance performance and functionality.

**Time: Three Hours**

**Maximum Marks: 100**

**PART A (4\*20 = 80 Marks)**

- |       |  |   |     |                   |
|-------|--|---|-----|-------------------|
| 1. a) | Explain the concept of random fibrous assemblies and their anisotropy characteristics.   | 2 | CO1 | [K <sub>3</sub> ] |
| b)    | Compare two-dimensional and three-dimensional fibrous assemblies.<br>Scenario:<br>A healthcare manufacturer is designing a new range of surgical gowns and wound dressings. They aim to incorporate nonwoven and 3D stitched structures to enhance barrier properties and breathability. | 2 | CO1 | [K <sub>2</sub> ] |
| c)    | Explain the concept of nonwoven structures and how they can be optimized for medical applications.   | 8 | CO1 | [K <sub>3</sub> ] |
| d)    | Suggest a combination of fibrous assemblies for wound dressing and justify your choice based on their functional requirements.   | 8 | CO1 | [K <sub>3</sub> ] |
| 2. a) | What are the advantages of 3D woven fabrics over traditional fabrics?  | 2 | CO2 | [K <sub>3</sub> ] |

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|-------|---|----|-----|-------------------|
| b)    | Describe the manufacturing process of 3D multilayer interlock weave.  | 2  | CO2 | [K <sub>3</sub> ] |
| c)    | Explain in detail the manufacturing processes of 3D dual interlaced weave.                                    | 16 | CO2 | [K <sub>3</sub> ] |
| 3. a) | Summarize the tensile properties of multilayered fabrics.   | 2  | CO3 | [K <sub>3</sub> ] |
| b)    | List the application of multiaxial warp-knitted fabrics.  | 2  | CO3 | [K <sub>3</sub> ] |
| c)    | Describe the knitting action of any one multiaxial warp-knitted fabrics manufacturing machine.                | 16 | CO3 | [K <sub>3</sub> ] |
| 4. a) | Discuss the general structure of shaped 3D nonwoven fabrics.  | 2  | CO4 | [K <sub>4</sub> ] |
| b)    | Highlight key applications of 3D braided and nonwoven fabrics in modern industries.                           | 2  | CO4 | [K <sub>3</sub> ] |
| c)    | Compare track and column braiding processes. Discuss the role of custom machine configurators in 3D braiding. | 16 | CO4 | [K <sub>4</sub> ] |

**Answer any ONE Question  
PART B (1\*20 = 20 Marks)**

- |           |  |     |                   |
|-----------|--|-----|-------------------|
| 5.        | Discuss the tensile, shear, and compressive properties of 3D woven fabrics. Explain how these properties influence their applications.                               | CO1 | [K <sub>5</sub> ] |
| <b>OR</b> |  |     |                   |
| 6.        | Analyze the applications of high bulk nonwovens and shaped 3D nonwoven fabrics. How have advancements in these areas impacted industries like aerospace and medical? | CO5 | [K <sub>5</sub> ] |

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