



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3172904**

**Semester: VII**

**Subject Name: Yarn Structure & Fabric Geometry**

**Type of course:** Professional Elective Course

**Prerequisite** : Students should have knowledge of basic yarn and fabric formation methods.

**Rationale** : The structural analysis of yarn properties and fabric geometry is very essential to develop abilities to understand the structure-property relationship.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

### Content:

Sr. No.	Content	Total Hrs
1	<b>Yarn Structure:</b> Types of yarn, Structural parameters of yarn, Role of yarn structure on yarn and fabric properties.	2
2	<b>Twist in Yarn:</b> Definition of twist, basic geometry of twisted yarns, idealized helical yarn structure, yarn diameter & density, schwarz constant, specific volume of yarns, hamilton method, yarn count & twist factor, twist contraction, contraction & retraction factor, packing of fibres in yarn, idealized packing, open packing, close packing, concentrating factors, disturbing factors	10
3	Theoretical analysis of effect of fiber properties and their geometrical configuration on the tensile properties of yarn, Theories and analysis of yarn strength, An introduction to spun yarn mechanics.	5
4	<b>Migration:</b> Definition of Migration, Ideal Migration, Measurement of Migration Parameters	3
5	<b>Fabric Cover:</b> Theory of cloth cover, Fractional cover of warp and weft, Cover factor, Total Cover factor, Geometry of square plain cloth, Maximum cover and crimp possible for plain and other weave fabrics, Generalized equation for maximum cover, Numerical based on the same.	6
6	<b>Geometry of Plain Weave:</b> Peirce model for the geometry of cloth structure. Special cases like crimp interchange, when weft is straight, when warp yarn is jammed, when both yarns are jammed, when cloth is straight etc. Physical (or Elastica) model for fabric geometry, the geometry of the jammed condition (Race track cross section), Numerical based on the above.	8
7	Fabric density and specific volume, Porosity, Permeability and all the equations related to	4



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	fabric porosity.	
8	<b>Tensile properties of fabrics:</b> Definitions of the terms like Poisson Ration, Anisotropic, isotropic, orthotropic etc. Typical load extension curve for the fabric with different zones. Geometrical changes during the extension of fabric.	4

### Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	25	5	5	0

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

1. Structural mechanics of fibres yarns and fabrics, Hearle J W S, Grosberg P and Backer S, Wiley Interscience, New York, 1969.
2. Textile Yarns, Goswami B C Martindale J G and Scardino F, Wiley Interscience Publisher, Newyork, 1995.
3. Mechanics of flexible fibre assemblies, Hearle J W S, Thwaites J J and Amirbayat J, S. and N. International Publishers BV, Netherlands, 1980.
4. Journals: Textile Research Journal, Princeton, USA and Journal of Textile Institute, Manchester, UK.
5. Woven Cloth Construction, Robinson A.T.C. and Marks R., The Textile Institute, 1973.
6. Woven Textile Structure: Theory and Application, B.K. Behera and P.K.Hari, Woodhead Publishing series in Textile, U.K.
7. Structure and Mechanics of Woven Fabrics, Hu, Jinlian, The Textile Institute, 2004.
8. J. Text. Inst. 28, T45, 112, Peirce F.T. 1937.

### Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the effect of yarn diameter, twist and packing on yarn structure and its properties.	25
CO-2	Established relationship between fibre and yarn for tensile properties.	10
CO-3	Understand effect of fibre migration on yarn properties.	10
CO-4	Established relationship between fabric structural parameter and properties.	35
CO-5	Application yarn and fabric geometry on performance.	20

**List of Open Source Software/learning website:** Any Search Engine, NPTEL, Swayam portal etc.