

# GUJARAT TECHNOLOGICAL UNIVERSITY

**TEXTILE TECHNOLOGY (29)**  
**SUBJECT NAME: Yarn Structure and Fabric Geometry**  
**SUBJECT CODE: 2172904**  
**B.E. 7<sup>th</sup> SEMESTER**

**Type of course:** Engineering

**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 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)	
PA	ALA	ESE	OEP							
4	0	0	4	70	20	10	0	0	0	100

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; AL-Active learning assignments; OEP-Open Ended problem

Sr. No.	Content	Total Hrs	% Weightage
1	Types of yarn. Structural parameters of yarn. Role of yarn structure on yarn and fabric properties.	4	8
2	Yarn diameter and density. Elements of yarn geometry. Geometry of helix and its application to yarn structure. Twisting forms and yarn contraction. Fibre packing in yarns	8	16
3	Theoretical analysis of effect of fiber properties and their geometrical configuration on the tensile properties of yarn. Theories and analysis of yarn strength and irregularity. An introduction to spun yarn mechanics.	8	16
4	Introduction only to fiber migration characteristics of continuous filament and spun yarns.	5	10
5	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.	7	14
6	Geometrical model of woven fabric. 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	12	22

	geometry. The geometry of the jammed condition (Race track cross-section). Numerical based on the above.		
7	Tensile properties of fabrics. 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.	7	14

**Suggested Specification table with Marks (Theory):**

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

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

**Course Outcome:**

After learning the course the students should be able to:

1. Understand basics of structure and geometry for both spun and filament yarns.
2. Apply the yarn structure knowledge for understanding behavior during and after spinning.
3. Establish relationship between structure and properties of yarn.
4. Acquire more knowledge in basic concepts of application of fabric structure and mechanics in textile
5. Develop suitable model for experimental work.
6. Establish relationships amongst various structural aspects of yarn and fabric with the properties and product design.

**List of Open Source Software/learning website:** <http://nptel.iitm.ac.in>, World Wide Web, Google Search Engine etc.

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.