



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Textile Engineering

Subject Code : ME02025021

Subject Name : Structural Mechanics of Fabric

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	PCC

Prerequisite:	Theory of Yarn structures at BE and ME level. Elements of fabric structure and principles of weaving at BE level.
Rationale:	Understanding the theoretical relationships between fabric parameters enables the fabric designer to play with different fibers, yarn and other construction parameters. The objective of the course is to familiarize the students with general understanding of structure-property relationships of various types of fabrics. These relationships provide simplified formulae to facilitate calculations which are of value for cloth engineering, problems of structure and mechanical properties.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand basics of fabric geometry and its relation with properties. Understand basic cloth setting theories and its application.	R,U
02	Understand Pierce model and related conditions and learn how the same can be applied practically.	R,U
03	Learn the tensile properties of fabrics and its implications in various processes and later on use.	U,A,E
04	Develop basic concept about buckling, shear and drape aspects of fabrics and establish relation with properties.	U,A,E,C
05	Understand basic concepts of geometrical aspects of knitted and non-woven fabrics.	R,U

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA / CA (M)	PA/CA (I)	ESE (V)	
3	1	0	4	70	30	0	0	100



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Elements of fabric geometry, Structure Property relationship, cloth setting, cloth setting theories, cover factor, fabric Sett and its calculation, maximum cover and its importance. shrinkage and their mechanisms in woven fabrics, relaxed fabric and its calculations.	8	19
2.	Geometrical model of woven fabric. (Pierce model), equation of yarn path in woven fabrics, introduction to the later modifications, jamming of threads, cover and crimp interchange in woven fabrics with respect to simple geometry, introduction to elastica, Geometry of non plain fabrics, Concept of similar cloths, application of cloth geometry.	8	19
3.	Tensile properties of woven fabrics, geometrical changes during extension of cloth, different cases of load extension modulus, local deformation during uniaxial loading, biaxial tensile loading.	6	14
4.	Buckling of fabrics, Euler's buckling column theory, buckling of elastic materials, experimental confirmation	6	14
5.	Pure shear, simple shear, calculation of shear parameters, shear hysteresis, initial shear behaviour of plain woven fabrics, drape of woven fabrics, drape parameters, factors influencing drape coefficients	6	14
6.	Compression behaviour of woven fabrics, low stress compression characteristics, predicting compression behaviour of woven fabrics	5	10
7.	Overview of geometrical properties of knitted and non-woven fabrics.	6	10
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	35	10	10	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Robinson A.T.C. and Marks R. "Woven Cloth Construction", The Textile Institute, 1973



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2. B.K. Behera and P.K.Hari, “Woven Textile Structure: Theory and Application”, Woodhead Publishing series in Textile, U.K.
3. Hearle J W S, Grosberg P and Backer S (1969) “Structural Mechanics of Fibers, Yarns and Fabrics”, Wiley Interscience, New York.
4. Hu, Jinlian, “Structure and Mechanics of Woven Fabrics”, The Textile Institute, 2004
5. Peirce F.T. J. Text. Inst. 28, T45 – 112 (1937)

(b) Open source software and website:

1. <https://nptel.ac.in>
2. World Wide Web, Google Search Engine etc.

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