

GUJARAT TECHNOLOGICAL UNIVERSITY

TEXTILE ENGINEERING (25)

THEORY OF FABRIC STRUCTURES

SUBJECT CODE: 2722508

SEMESTER: II

Type of course: Core

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 tex, threads per centimeter and weave to vary texture and other fabric properties. These relationships provide simplified formulae to facilitate calculations which are of value for cloth engineering, problems of structure and mechanical properties.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Elements of woven fabric structure. Regular and irregular weaves. Modeling different weaves & weave Factor. Calculation of weave factor	4	8
2	Geometrical modeling of woven fabric structure. A simple geometric model of woven fabric structure. Jammed structures, Non-circular cross-section, Elliptical cross-section, Racetrack cross-section. Using the model to predict the fabric thickness, cover, mass and specific volume. Modeling maximum fabric cover. Calculating fabric properties: numerical examples.	10	25
3	Predicting woven fabric properties using a geometric model. Predicting woven fabric parameters for different structures. Predicting the weavability limit. Predicting cover in different woven structures. Woven fabric properties after structural modifications. Crimp interchange phenomena. Maximum fabric extension. Other structural changes.	11	25
4	Shrinkage in woven fabrics. Mechanisms of fabric shrinkage. The relationship between cloth and yarn shrinkage. Predicting fabric shrinkage. Application of fabric shrinkage model.	4	12
5	Tensile behavior of woven fabrics. Fundamentals of axial deformation, Poisson Ratio, Tensile properties of woven fabrics, geometrical changes during extension, biaxial loading under large stresses, Castigliano's theorem, fabric extension in bias direction,	6	15
6	Buckling behavior of woven fabrics under deformation, Bending behavior of woven fabric, bending behavior, bending rigidity, recovery, hysteresis, Creasing in woven fabrics. Shear behavior of woven fabrics, Friction and other aspects of the surface behavior of woven fabrics.	7	15

Reference Books:

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

Course Outcome:

After learning the course the students should be able to:

1. Acquire more knowledge in basic concepts of application of fabric structure and mechanics in textile
2. Improve problem evaluation technique.
3. Select an appropriate method to solve a practical problem.
4. Develop suitable model for experimental work.
5. 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.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.