# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3162903**

**Semester:** B.E. Semester VI

## Subject Name: Physical Testing

**Type of course:** Professional Core Course

**Prerequisite:** Students should have knowledge of Physics and Mathematics of 10+2 level and basic statistics as well as basic processes of textile manufacturing.

**Rationale:** Physical Testing of fibre, yarn and fabric is very essential for quality check, validation of the processes and commerce.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 4 | 0 | 2 | 5 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1. | **Introduction:** Aim and scope of testing, Selection of sample, type of sample, Sampling techniques for fibre, yarn and fabrics. | 4 |
| 2. | **Moisture Relation and Testing:** Terms and definitions, relation between relative humidity and regain of textile materials. Measurement moisture regain & content - Principle and operation of equipment. | 4 |
| 3. | **Testing of Fibres:** Measurement of fibre length, fineness, maturity, crimp, strength and elongation, neps, trash content and grading of different cotton. Evenness testing of laps, slivers and roving. Application of HVI and AFIS. | 10 |
| 4. | **Testing of Yarn:** Yarn numbering and conversion system, measurement of yarn twist, hairiness, tensile properties and Unevenness & imperfection. Various instruments for testing yarn properties—their principle of operation and inter-relations between different instruments. | 10 |
| 5. | Mechanical behavior of textiles. Terms and definitions, expressing the results, quantities and units, mechanical conditioning and recovery properties of textiles | 2 |
| 6. | Principle of CRL, CRT and CRE type tensile testing machines - various instruments, factors affecting the results of tensile testing of fabrics. Evaluation and interpretation of tensile test results obtained for fabrics. | 4 |
| 7. | **Fabric Strength Testing:** Tensile, tearing and bursting strength tests; principles and operation of equipment | 4 |

| | | |
|---|---|---|
| **8.** | **Methods of tests for fabric dimensions and other physical properties:** thickness, weight, crimp, shrinkage, air permeability, wettability, shower-proofness, waterproofness and flame-resistance. | **8** |
| **9.** | **Fabric handle, bending and draping properties:** Fabric Handle and drape, creasing and crease recovery and Stiffness, terminology, quantities and units. Experimental method. | **5** |
| **10.** | **Serviceability, wear and abrasion:** Definitions, methods for measuring abrasion resistance, pilling and evaluation of results. | **5** |

**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 |
| **10** | **25** | **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. Physical Testing of Textiles by B. P. Saville, 1999, Woodhead Publishing Ltd., U. K.
2. Principles of Textile Testing by J. E. Booth, 1961, Heywood Books, London.
3. Testing and Quality Management– Ed. by V. K. Kothari, IAFL Publications, New Delhi.
4. Handbook of Textile Testing and Quality Control by E. B. Grover and D. S. Hamby.
5. Textile Testing by Angappan P & Gopalakrishnan R, SSM Institute of Textile Technology, Komarapalayam, 2002.
6. Textile Testing by Basu A, SITRA Coimbatore, 2002.
7. Textile Testing fibre and yarn testing by Dr. C. V. Koushik & Mr. R. Chandrasekaran, NCUTE, 2004.

**Course Outcomes:** After learning the course, students should be able to:

| **Sr. No.** | **CO statement** | **Marks % weightage** |
|---|---|---|
| **CO-1** | Prepare the samples to be required for different testing methods. | 10 |
| **CO-2** | Test the fibres for different properties. | 25 |
| **CO-3** | Test the yarns for different properties. | 25 |
| **CO-4** | Test the fabrics for different properties. | 30 |
| **CO-5** | Interpret the different test results of fibre, yarn and fabric. | 10 |

**List of Experiments:**

1. Fibre Length by fibrograph method
2. Determination of trash content in cotton.
3. Determination of fibre fineness using air flow method and gravimetric method .
4. Determination of fibre bundle strength using pressley tester and stelometer
5. Determination of various fiber properties using HVI and AFIS
6. Yarn grading by visual examination
7. Yarn count using gravimetric method and Knowles balance
8. Measurement of twist by manual and electronic method.
9. Determination of lea strength of given yarn using lea tester
10. Determination of thread strength of the given yarn using UTM
11. Measurement of hairiness of the spun yarns.
12. Measurement of evenness of sliver, roving and yarn using evenness tester
13. Measurement of ballistic strength of lea using impact strength tester.
14. Crimp rigidity measurement for filament yarn.
15. Measurement of snarling using snarl indicator.
16. Determination of threads per inch of the given fabric cloth using densi meter and pick glass
17. Determination of thickness of given fabric using a thickness gauge
18. Determination of GSM of the given sample using quadrant balance and gravimetric method
19. Determination of crimp percentage of given fabric using crimp tester
20. Determination of flexural rigidity and bending modulus of the given fabric using stiffness tester
21. Determination of drape of the given fabric using drape tester
22. Determination of crease recovery angle of the given fabric using crease recovery tester
23. Determination of pilling resistance of the given fabric by pill box method and abrasion method
24. Determination of abrasion resistance of the given fabric using abrasion tester
25. Determination of fabric strength of the given fabric using UTM
26. Determination of bursting strength of the given fabric using bursting tester
27. Determination of tearing strength of the given fabric using KMI tearing tester

**Major Equipment:**

1. Digital Fibrograph
2. Fiber Fineness Tester
3. Fiber Strength Tester – Stelometer
4. Fiber Strength Tester – Pressley Tester
5. Fiber Property testing using HVI & AFIS
6. Trash Analyzer
7. Wrap Reel for spun and filament yarns
8. Weighing Balance
9. Twist tester – Manual and Digital
10. Tensile Strength Tester
11. Lea strength tester
12. Ballistic Strength tester
13. Snarl indicator
14. Crimp rigidity tester
15. Yarn hairiness tester
16. Evenness tester for sliver and roving

17. Knowles balance
18. Tensile tester
19. Drape meter
20. Pilling tester
21. Abrasion tester
22. Tearing strength tester
23. Bursting strength tester
24. Fabric stiffness tester

**List of Open Source Software/learning website:**

- Web sites of textile testing instrument manufacturers, namely Uster, SDL etc.,
- BIS, BS, ASTM and other standard methods of textile testing.
- http://nptel.iitm.ac.in, World Wide Web, Google Search Engine etc.