GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-II

Course Title: Fundamentals of Fabric Technology
(Course Code: C4325901)

Diploma programme in which this course is offered	Semester in which offered
Textile Design	Second

1. RATIONALE

Fabric manufacturing is the most important stage in textile. Diploma engineers have to create different outfits & garments. For this purpose different type of fabric is required, which is made of different methods such as for woven, knitted, non-woven and other kinds of fabrics. For them, knowledge about fundamental concepts of fabric manufacturing technology is vital to work in the textile industry. Hence this course aims to develop basic knowledge and skills related to fabric manufacturing processes and technology used in the industry. They will learn different methods of fabric productions such as weaving, knitting, Non-woven, lace making, felting, braiding, and plaiting.This course is developed in the way by which fundamental information will help the diploma engineers to apply the basic principles of fabric technology in textile designing to solve broad based problems.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Select appropriate fabric using relevant manufacturing technique based on the fabric structure.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- Select relevantfabric manufacturing technique for the given fabric.
- Select relevant fabric preparatory process for woven fabric.
- Select conventional & unconventional weaving machine for the given woven fabric.
- Use relevant manufacturing technique for fabrics other than woven fabric& waste handling methods.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme	Total Credits	Examination Scheme

(In Hours)			(L+T/2+P/2)	Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, CA - Continuous Assessment; ESE -End Semester Examination.

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1.	Classify different types of Fabrics on bases of their structure.	I	02
2.	Draw passage of warp yarn through winding machine.	II	02
3.	Draw passage of weft yarn on pirn winding machine.	II	02
4.	Draw passage of warp yarn through beam warping&sectional warping machine.	II	02
5.	Draw line diagram of various types of creel usedfor warping machine.	II	02
6.	Draw passage of yarn through sizing machine.	II	02
7.	Draw passage of warp through plain power loom & identify the various parts.	III	02
8.	Draw line diagram of Primary, Secondary & Auxiliary motions.	III	02
9.	Draw line diagram of dobby mechanism.	III	02
10.	Draw line diagram of SLSC, DLSC & DLDC jacquards.	III	02
11.	Draw line diagram of weft insertion sequence in projectile loom.	III	02
12.	Draw line diagram Dewas&Gabler weft insertion system in rapier loom.	III	02
13.	Draw line diagram of weft insertion sequence in Air Jet loom & Water Jet loom.	III	02
14.	Draw line diagram of Knitting, Braiding & lacing.	IV	02
		28Hrs	

Note

- More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed Practical Exercises of this course required which are embedded in the COs and ultimately the competency..

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20

2	Perform the practical procedure according to instructions	20
3	Follow safe practices and measures during working on machine	10
4	Observe the outcomes correctly	20
5	Interpret the result and conclude	30
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Winding machine	2,3
2.	Warping machine	4,5
3.	Sizing machine	6
4.	Plain power loom	7, 8, 9, 10
5.	Shuttle-less weaving machines	11, 12, 13
6.	Knitting machine	14
7.	Braiding machine	14

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfil the development of this competency.

- Work as a leader/a team member.
- Follow ethical practices.
- Practice environmental friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics

Unit – I **Fabric Classification**	1a. Define Fabric 1b. Classify different types of Fabrics 1c. Classify the fabric manufacturing technologies	1.1 Definitions of fabric 1.2 Classification of fabrics based on their structure and end uses 1.3 Classification of fabrics manufacturing technologies
Unit – II **Woven fabric - Preparatory**	2a. Describe objectives of winding, warping, sizing 2b. Explain process for winding, warping, sizing 2c. Explain winding machine and its automations. 2d. Select warping machine according to end product.(direct and sectional warping) 2e. Explain sizing process along with their ingredients. 2f. Carryout production calculations practiced in the industry.	2.1 Sequence of weaving preparatory process. 2.2 Objects of package winding, Warping, Sizing, pirn winding. 2.3 Basic operations & automatic mechanisms of Package and pirn winding machine. 2.4 Classification of warping machine 2.5 Features of Modern High Speed warping machine(direct and sectional warping) 2.6 Sizing ingredients & their functions 2.7 Preparation of size paste 2.8 Methods / Techniques of sizing process 2.9 Sizing machines. 2.10 Calculations of Winding, Warping, Sizing processes.
Unit– III **Woven fabric – Conventional machine**	3a. Explain mechanisms and motions of a plain power loom 3b. List different types of dobby 3c. Explain working principle of dobby 3d. Differentiate different types of jacquard 3e. Explain working principle of jacquard	3.1 Passage of warp and cloth through a plain power loom 3.2 Primary motion of loom. (Objects, Types) a) Shedding motion- Different shedding mechanism, Types of shed b) Picking and checking motion - different types of picking, Picking accessories, Shuttle box. c) Beating up motion - Beat up motion with timing and settings, Different types of reed and Heald shaft. 3.3 Secondary motion of loom with objects and different type -take up, let off 3.4 Auxiliary motions - warp protector motion, Weft stop motion, Temples, 3.5 Need of dobby &its classification 3.6 Construction & Working of various dobby. 3.7 Need of Jacquard &its Classification 3.8 Construction & Working of various Jacquard
Unit– IV	4a. Differentiate Conventional and Unconventional looms (Shuttle	4.1 Comparison between conventional and Unconventional looms (Shuttle less).

Woven fabric – Unconventional machine	less). 4b. Describe modern developments and process parameters for preparatory process 4c. Describe the need of weft accumulator on shuttle less looms 4d. Explain features of projectile weaving. 4e. Explain features of Rapier weaving machines. 4f. Explain features of Air-jet weaving machines. 4g. Differentiate between air jet and water jet. 4h. Describe advantages and limitations in Multiphase loom	4.2 Types of Shuttle less weaving machines 4.3 Weft accumulator, Weft measuring systems, Weft cutters 4.4 Projectile weaving machine: features and useWeft insertion sequence in projectile weaving machine 4.5 Types of Rapier weaving machines: Rigid, Flexible 4.6 Weft insertion methods of Rapier: Dewas system, Gabler system 4.7 Sequence of weft insertion in Air jet looms 4.8 Weft supply system, Picking system, Weft insertion in Water jet loom 4.9 Multiphase weaving machine 4.10 Recent Automations in Shuttleless weaving machines
Unit– V Other Fabric Technologies and Sustainability In fabric production	5a. Identify Other Fabric manufacturing technologies 5b. Explain Knitting & Non-Woven Technology 5c. Identify Lacing, Braiding, felting technologies 5d. Suggest methods of handling wastes generated during fabric manufacturing process.	5.1 Fabric technologies other than weaving 5.2 Principle of Knitting 5.3 Technology of Non-Woven fabrics 5.4 Fundamentals of Lacing&Braiding 5.5 Felting technology 5.6 Methods to handle wastes generated during fabric manufacturing process

***Note**: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
I	Fabric Classification	04	2	4	4	10
II	Woven fabric - Preparatory	12	3	6	6	15
III	Woven fabric - Conventional Machines	14	2	8	10	20
IV	Woven fabric - Unconventional Machines	08	2	4	4	10
V	Other Fabric Technologies and Sustainability In fabric production	08	2	4	4	10

Total	**48**	**12**	**28**	**30**	**70**

***Legends**: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular activities** which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Classify various fabrics according to their structure.
- Explore library/internet for production technologies being used for production of different fabrics and make a report.
- Visit to textile industry and preparing report with sketches.
- Prepare line diagram of weaving mechanisms.
- Undertake micro-projects in teams.
- Give seminar on any relevant topic.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- Guide student(s) in undertaking micro-projects.
- 'L' in section No. 4means different types of teaching methods that are to be employed by teachers to develop the outcomes.
- About 20% of the topics/sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-learning, but to be assessed using different assessment methods.
- With respect to section No.11, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide students on how to address issues on environment and sustainability
- Guide students for using data manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more

COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- **Classify fabric**: Collect samples of various types of fabric and prepare comparative report based on their manufacturing. (**Duration: 6-8 hours**)
- **Woven fabric:** Prepare a compiled report of various Conventional and Unconventional weaving technology with machine mechanisms. (**Duration: 8-10 hours**)
- **Knitted fabric:** Prepare a compiled report of various knitting technology with machine mechanisms. (**Duration: 6-8 hours**)
- **Braided/Lace fabric:**Collect various samples of briaded, laced, felted and other small width fabrics and prepare a comparative chart. (**Duration: 6-8 hours**)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Weaving machine, mechanisms and management	Talukdar, Sriramulu and Ajgaonakar	Publisher- Mahajan Publishers Private Limited, Ahmedabad ISBN:8185401160-9788185401164
2	Shuttleless loom	Vinscent	Publisher- The Textile Institute ISBN:0904095320-9780904095326
3	Weaving mech. II	Benarjee N. N .	Publisher- Textile Book House ISBN: NA
4	Principle of weaving	Marks, R. and Robbinsons	Publisher- The Textile Institute Manchester ISBN:0900739258 - 9780900739255
5	Modern Developments in Weaving	Duxbury and Wray	Publisher- Columbine press ltd. ISBN:0900298111 - 9780900298110
6	Knitting technology	David J Spencer	Publisher- Woodhead Publishing Ltd. ISBN: 1855733331
7	Handbook on fabric manufacturing	P. Purushothama	Publisher- Woodhead Publishing Ltd. ISBN: 9385059165 - 9789385059162

14. SOFTWARE/LEARNING WEBSITES

- https://nptel.ac.in/courses/
- http://www.textileworld.com/

- www.learningseed.com
- http://www.teonline.com/knowledge-centre/
- http://www.sitra.org.in
- http://www.btraindia.com
- www.nitratextile.org/
- http://www.textileassociationindia.org/
- http://www.nitma.org/
- www.itamma.org/
- http://www.uttaindia.org/
- http://en.wikipedia.org/wiki/weaving
- http://textilelearner.blogspot.in
- http://sazidrahman.blogspot.in/2009/02/lecture-notes-on-weaving-technology.html
- http://www.elearning-textiles.co.uk/CatalogueofModules/
- https://textilestudycenter.com/
- https://www.fibre2fashion.com/
- http://www.texmechwarp.com
- http://karlmayer.com
- http://en.wikipedia.org/wiki/weaving
- http://www.jupitercompex.com
- http://en.wikipedia.org/wiki/Dobby_loom
- www.staubli.com
- www.textileworld.com
- http://www.lakshmiautomatic.com/
- http://en.wikipedia.org/wiki/Jacquard_loom
- http://www.shaktiautolooms.com/
- http://collections.infocollections.org/ukedu/en/d/Jh2379e/5.4.html
- http://www.cs.arizona.edu/patterns/weaving/books/pea_jacq_1.pdf
- http://encyclopedia2.thefreedictionary.com/Jacquard+loom
- www.scribd.com/doc/86427900/Preparatory-Process-for-Weaving
- www.itemagroup.com/documents/brochures/p7300hp/P7300HP_EN.pdf
- http://textilelearner.blogspot.in/2012/01/projectile-loop-projectile-weaving.html
- www.fibre2fashion.com/industry.../weaving-weft-insertion-rapier1.asp
- www.rapierloom.in/rapier-looms.html
- http://textilelearner.blogspot.in/2013/01/main-parts-of-air-jet-loom-for-weft.html
- www.indiantextilejournal.com/articles/FAdetails.asp?id=4557
- www.sulzer.com/mr/-/media/.../Cross.../1999_03_8_sartorius_e.pdf

15. PO-COMPETENCY-CO MAPPING

Semester II	**Fundamentals of Fabric Technology (Course Code: C4325901)**								
	POs and PSOs								
Competency & Course Outcomes	**PO 1** Basic & Discipline specific knowledge	**PO 2** Problem Analysis	**PO 3** Design/ development of solutions	**PO 4** Engineering Tools, Experimentation & Testing	**PO 5** Engineering practices for society, sustainability & environment	**PO 6** Project Management	**PO 7** Life-long learning	**PSO 1**	**PSO 2**
Competency	***Select appropriate fabric using relevant manufacturing technique based on the fabric structure.***								
Course Outcomes CO a)	3	2	-	1	-	-	2	1	1
CO b)	3	2	-	1	2	-	2	1	1
CO c)	3	1	-	1	2	1	2	1	2
CO d)	3	1	-	1	3	-	1	-	-

Legend: '3' for high, '2' for medium, '1' for low or '-' for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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