GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Weaving Technology-I
(Course Code: 4322903)

Diploma programmes in which this course is offered	Semester in which offered
Textile Manufacturing Technology	Second

1. RATIONALE

Fabric is final end product of mainline textile activity. The yarn is required to pass through preparatory processes before actual fabric making starts. Preparatory is very significant for the success of fabric formation process. Weaving is one of three important method of fabric formation. The main device for making woven fabric, loom, has undergone developments from non-automatic to latest generation shuttle-less looms. Also, various ways of manipulating warp and weft yarn for manufacturing various woven structures have evolved fully. In this course, the students are exposed to knowledge of weaving process, power looms, its preparatory processes and production calculations.

2. COMPETENCY

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

- **Use winding, pirn winding and plain power loom for making cheese/cone, pirn and fabric respectively**.

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Use winding machine for producing yarn packages as per requirements.
b) Use pirn winding machine for producing pirn as per requirements.
c) Use plain power loom for fabric formation as per specifications.
d) Apply process of recycling weaving waste.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	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 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) are the sub-components of the COs. *Some of the **PrOs** marked **'*'** (in approx. Hrs column) 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	Demonstrate the passage of yarn through winding machine.	I	02*
2	Use various types of yarn clearer to remove yarn faults.	I	02*
3	Use various types of yarn tensioner.	I	02*
4	Use various types of yarn traversing mechanism.	I	02*
5	Use various types of packages driving mechanism.	I	02*
6	Use yarn joining methods to join yarn ends on winding machine.	I	02
7	Demonstrate the passage of yarn through pirn winding machine.	II	02
8	Set pirn diameter, taper & length of wind on pirn winding machine.	II	02*
9	Demonstrate the passage of yarn through plain power loom.	III	02*
10	Use tappet shedding mechanism for shed formation.	III	02*
11	Use picking mechanism for inserting the weft yarn.	III	02*
12	Use beat up mechanism to beat the weft yarn up to fell of the cloth.	III	02*
13	Use let off mechanism to maintain yarn tension.	III	02*
14	Demonstrate five wheels take up mechanism to maintain pick density.	III	02
15	Demonstrate seven wheels take up mechanism to maintain pick density.	III	02*
16	Demonstrate side weft fork mechanism to avoid fabric defects.	III	02*
17	Demonstrate warp stop mechanism to avoid fabric defects.	III	02*
	Minimum 14 Practical Exercises		**28 Hrs.**

Note

i. *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.*

ii. *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 which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Identify components.	10
2	Prepare experimental setup.	20
3	Operate the equipment setup.	20
4	Follow safe practices.	10
5	Record observations correctly.	20

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
6	Interpret the result and conclude.	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment 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 with speed of 600-800 m/min with grooved drum, electronic yarn clearer and splicer or knotter.	1 to 6
2	Automatic Pirn Winding Machine with speed of 600-800 RPM with bunching, traversing and advancing mechanism.	7 to 8
3	Plain power loom with speed up to 120 RPM, negative tappet shedding using eight (8) Heald shafts, (7) seven-wheel take-up motion, positive let-off motion, mechanical serrated bar warp stop, weft stop, temple, brake and warp protector mechanism.	9 to 17

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 fulfill the development of this course t competency.

a) Work as a leader/a team member.
b) Follow safety practices while using equipment.
c) Realize importance of green energy.

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:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. 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 different levels)	Topics and Sub-topics

Unit – I **Cone/ Cheese Winding**	1a. Explain various functions of winding machine. 1b. Classify types of winding machine. 1c. Explain various mechanisms of winding machine. 1d. Explain winding package faults. 1e. Calculate output production of winding machine from given data.	3.1 Sequence of weaving preparatory process. 3.2 Objects of winding. 3.3 Classification winding machine. 3.4 Methods of package driving and yarn take up. 3.5 Methods of yarn traversing. 3.6 Type of wind. 3.7 Yarn clearing device, Tensioning device, Balloon breaker, Automatic thread stop motion, Driving arrangement, Anti- patterning device, Angle of wind. 3.8 Automation in winding (Knotter, Types & quality of knot, Splicing, Comparison of knotting & splicing) 3.9 Defects of winding package 3.10 Caddy system 3.11 Production calculations
Unit – II **Pirn Winding**	2a. Describe need of pirn winding. 2b. Explain pirn winding machine. 2c. Describe pirn winding package faults. 2d. Calculate output production of pirn winding machine from given data.	2.1 Objects of Pirn winding 2.2 Advantage of rewound weft over direct weft 2.3 Automatic Pirn winding machine 2.4 Various adjustments on auto pirn winding Machine. 2.5 Package fault in pirn winding 2.6 Production calculations.
Unit– III **Basics of Weaving**	3a. Classify types of loom. 3b. Explain shedding motions of a plain power loom- basic cloth making machine. 3c. Explain picking motions of a plain power loom- basic cloth making machine. 3d. Explain beat-up motions of a plain power loom- basic cloth making machine. 3e. Explain take-up motions of a plain power loom- basic cloth making machine. 3f. Explain let-off motions of a plain power loom- basic cloth making machine. 3g. Explain warp protector motions of a plain power loom- basic cloth making machine.	3.1 Classification of loom. 3.2 Primary motion of loom. 3.3.1 Shedding motion- different shedding mechanism, types of shed, tappet shedding motion with timing and settings, early and late shedding, Heald staggering, dwell period. 3.3.2 Picking and checking motion - different types of picking mechanism, over pick and under mechanism with timing and settings, picking accessories, Shuttle box. 3.3.3 Beating up motion - Beat up motion with timing and settings, Different types of reeds and Heald shaft, Reed

	3h. Explain warp stop motions of a plain power loom- basic cloth making machine. 3i. Explain weft stop motions of a plain power loom- basic cloth making machine. 3j. Describe the types and working of temples. 3k. Describe cloth defects & remedies in a power loom. 3l. Calculate output production of plain power loom from given data.	Count and Heald count. 3.3 Secondary motion of loom. 3.3.1 Objects of take-up 3.3.2 Different types of take-up motion 3.3.3 Object of let-off 3.3.4 Different types of let-off motion 3.4 Auxiliary motions- Objects and type of: 3.4.1. Loose reed warp protector motion, 3.4.2. Fast reed Warp protector motion, 3.4.3. weft stop motion, 3.4.4. Temples, 3.4.5. Brake 2a. Cloth defects their causes and remedies 2b. Production calculations of plain power loom
Unit– IV **Recycling of Weaving Waste and Noise Pollution in Weaving**	2a. Describe need of recycling and types of waste in textile. 2b. Describe recycling of weaving waste in brief. 2c. Describe effects of noise pollution. 2d. Apply methods for noise pollution reduction	4.1 Types of waste in textile 4.1.1. Pre-consumer waste & 4.1.2. Post-consumer waste 4.2 Conversion into fibres from weaving waste by “Garneting machine” 4.3 Impact of noise pollution. 4.4 Methods to handle the noise level in textile industries.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Cone/cheese Winding	10	04	06	08	18
II	Pirn winding	06	02	02	06	10
III	Basics of weaving	20	08	10	14	32
IV	Recycling of weaving waste and Noise pollution in weaving	6	2	2	6	10
Total		**42**	**16**	**20**	**34**	**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 to 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. They also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare report on different manufacturers' winding machine based on industrial visit.
b) Prepare report on pirn winding machine based on industrial visit.
c) Prepare report on weaving machine based on industrial visit.
d) Give seminar on recent technological advancement of winding machine.

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:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) 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.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide students on how to address issues on environment and sustainability.
g) 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 (group of 3 to 5). However, **in the fifth and sixth semesters**, 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 duration of the micro-project should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students 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:

a) **Winding**: Prepare the report of different winding machines with their specifications.
b) **Pirn Winding**: Prepare the report of pirn machines with their specifications.
c) **Weaving**: Prepare the report of different weaving machines with their specifications.
d) **Loom-Primary Motions:** Prepare the report of different of primary mechanism of plain power loom by writing features of each component.
e) **Loom-Secondary Motions:** Prepare the report of different of secondary mechanism of plain power loom by writing features of each component.
f) **Loom-Auxiliary Motions:** Prepare the report of different of auxiliary mechanism of plain power loom by writing features of each component.
g) **Package defect**: Prepare a portfolio of samples of different types of package defects.
h) **Fabric defects:** Prepare a portfolio of samples of different types of fabric defects.
i) **Recycling of weaving waste and Noise pollution**: Prepare the report of different weaving waste, methods for reducing noise pollution in loom shed.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Weaving machine, material &management	Ajgaonakar D.B. &Talukdar	Mahajan Publisher Private Limited. Ahmedabad.1998. ISBN:81-85401-16-0
2	Weaving: conversion of yarn to fabric	Lord P.R. &Mohamed M.H.	Merrow Publishing Limited, England, 1992ISBN:0-900 -54178-4
3	Fundamentals of Yarn Winding	Korrane Milind	Woodhead Publication India PVT Ltd., New Delhi, 2013 ISBN: 978-93-80308-38-8
4	Weaving Preparation Technology	Gokarneshan N.	Abhishek Publications, Chandigarh, ISBN: 978-81-8247-247-1
5	Principle of Weaving	Marks & Robinson	The Textile Institute, Manchester, England,1976 ISBN:0-900739258
6	The mechanisms of Weaving	Thomas W. Fox	Textile Book Service, New Jersey, 1992, ISBN not available
7	Woven Textile	Gandhi K. L.	The Textile Institutes, New Delhi, 2012, ISBN 978-1-84569-930-7

14. SOFTWARE/LEARNING WEBSITES

1. https://nptel.ac.in/courses/116/102/116102005/
2. https://saurer.com/en/products/machines/winding/autoconer
3. https://textilevaluechain.in/in-depth-analysis/articles/textile-articles/noise-pollution-and-its-control-in-a-weaving-plant/
4. https://textilelearner.net/shedding-mechanism-in-weaving/
5. https://www.youtube.com/watch?v=0w1zcMflibE

6. https://www.youtube.com/watch?v=7eWA7IN0_U4
7. https://www.youtube.com/watch?v=fYa6hyCXunQ
8. https://www.youtube.com/watch?v=0w1zcMflibE
9. https://www.youtube.com/watch?v=g5_wRrBaGGY
10. https://indiantextilejournal.com/articles/FAdetails.asp?id=5955
11. https://www.youtube.com/watch?v=z2t1Qvg21uY

15. PO-COMPETENCY-CO MAPPING

Semester I	Weaving Technology-I (Course Code: 4322903)						
	POs						
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
Competency .	Use winding, pirn winding and plain power loom for making Cheese/Cone, pirn and Fabric respectively						
Course Outcomes CO a) Use winding machine for producing yarn packages as per requirements	3	2	2	2	2	2	2
CO b) Use pirn winding machine for producing pirn as per requirements	3	2	2	-	2	2	2
CO c) Use plain power loom for fabric formation as per specifications	3	2	2	2	2	2	2
CO d) Apply process of recycling weaving waste	3	2	2	2	3	-	2

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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