GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Modern Weaving Technology
(Course Code: 4362902)

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

1. RATIONALE

In the last two decades, spectacular progress has been made in the field of weaving technology and the most significant being the replacement of convectional looms by shuttle less looms for increasing productivity and quality of the end product. New developments in weaving have taken place in such a direction, which ensures reduced time, energy and cost involved. Heavy mechanical parts are now being replaced with electronic or microprocessor controlled alternatives. The emphasis on productivity and quality has forced the weaving technology to evolve new processes and equipment. Due to this technological change basic need of industries also changes. To fulfill the industries requirement of highly skilled technicians in modern weaving area, this course has been introduced.

2. COMPETENCY

The course content should be taught and implemented with the aim to achieve different types of skills leading to the achievement of the following competency. The student will be able to

Supervise fabric production by setting looms and maintaining process parameters on modern Looms.

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:

a. Manage preparatory processes of shuttle less weaving process.
b. Supervise weaving production equipment in weft insertion by projectile method.
c. Supervise weaving production equipment in weft insertion by rapier technology.
d. Supervise weaving production equipment in weft insertion by air jet technology.
e. Supervise weaving production equipment in weft insertion by water jet technology.
f. Supervise weaving production equipment in multiphase weaving and tri-axial weaving.

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	-	4	5	30*	70	50	50	200

(*): 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	Locate advantages in various types of shuttle less looms.	I	02*
2	Explore modern developments & processing parameters of preparatory processes.	I	02*
3	Draw sketch & explain weft insertion sequence in projectile loom.	I	04*
4	Draw sketch & explain beat up mechanism in projectile loom.	I	04*
5	Draw sketch & explain torsion bar picking mechanism in projectile loom.	II	04*
6	Locate types of selvedge formation.	II	02*
7	Draw sketch & explain dewas weft insertion system in rapier loom.	III	04*
8	Draw sketch & explain gabler weft insertion system in rapier loom.	III	04*
9	Draw types of air guides used in Air Jet loom.	IV	02*
10	Draw sketch & explain weft insertion sequence in Air Jet loom.	IV	04*
11	Draw sketch & explain picking system, in Water Jet loom.	IV	04*
12	Draw sketch & explain weft insertion system in Water Jet Loom.	IV	04*
13	Survey types of multiphase weaving machines.	V	02
14	Draw sketch & explain principle of Triaxial weaving.	V	04*
15	Observe & record latest developments in unconventional looms.	V	04*
16	Observe & record Modifications in Weft Insertion system in Air Jet loom	V	06
	Minimum 14 Practical Exercises		**56 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 %

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1	Identify components	10
2	Prepare of an experimental setup	20
3	Operate the equipment setup	20
4	Follow safe practices measures	10
5	Record observations correctly	20
6	Interpret the result and conclude	20
Total		**100**

5. 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	Projectile Loom	1,2,3,4,5,6
2	Rapier Weaving machine	7,8
3	Air jet weaving machine	9,10,16
4	Water jet weaving machine	11,12
5	Multiphase weaving machine	13
6	Tri axial weaving machine	14

6. 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/ team member.
b) Follow safety practices while using modern weaving machinery.
c) Realize the importance of green energy.
d) Practice environmentally friendly methods and processes.

The ADOs are best developed through 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 the 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 Preparatory Processes for Shuttle less Weaving	1a. Describe the types of shuttle less looms. 1b. Differentiate conventional and shuttle less looms. 1c. Describe modern developments and process parameters for preparatory process. 1d. Describe the need of weft accumulator on shuttle less looms. 1e. Explain environmental aspects in a modern loom shed.	1.1 Comparison between conventional and shuttle less looms. 1.2 Types of shuttle less looms. 1.3 Modern developments and processing parameters for Quality Yarn preparation: Winding, Warping, Sizing. 1.4 Weft accumulator, Weft measuring systems, Weft cutters, Types of selvedges. 1.5 Environmental aspects of modern loom shed.
UNIT-II Weft Insertion by Projectile	2a. Explain the features of projectile weaving. 2b. Explain weft insertion sequence in projectile weaving machine. 2c. Explain working of torsion picking mechanism. 2d. Describe beat up mechanism on Sulzer loom	2.1 Projectile weaving machine: features and advantages. 2.2 Weft insertion sequence in projectile weaving machine 2.3 Principle of torsion picking mechanism 2.4 Beat up mechanism on Sulzer loom
UNIT-III Weft Insertion by Rapier	3a. Describe the types of rapier looms. 3b. Describe the weft insertion system on rapier weaving machine. 3c. Explain the design and operation of rapier heads.	3.1 Types of Rapier looms 3.2 Weft insertion methods: Dewas System, Gabler System 3.3 Rapier heads
UNIT-IV Weft Insertion by Air Jet	4a. Describe essential requirements for Air Jet weft insertion. 4b. Differentiate types of air guide. 4c. Justify need of quality air. 4d. Describe weft insertion sequence in Air Jet loom. 4e. Explains factors affecting energy consumption in Air Jet looms.	4.1 Essential requirements for successful Air Jet weft insertion 4.2 Traverse aids for maintain air flow 4.3 Quality of Air, Methods of Air Jet control / air distribution control 4.4 Weft insertion sequence in Air Jet loom 4.5 Energy saving in Air Jet loom shed
UNIT-V Weft Insertion by Water Jet	5a. Differentiate between Air Jet and Water Jet 5b. Justify the importance of water quality 5c. Explain importance of Weft supply system on Water Jet loom 5d. Explain working of picking system of Water Jet loom	5.1 Comparison of Air Jet and Water Jet loom 5.2 Quality of water and other aspects of Water Jet loom 5.3 Weft supply system of Water Jet loom 5.4 Picking system of Water Jet loom 5.5 Weft insertion sequence in Water Jet

	5e. Describe weft insertion sequence in Water Jet loom 5f. Explain water recycling system in Water Jet loom	loom 5.6 Waste water recycling system for Water Jet loom
UNIT-VI Multiphase looms, Triaxial looms and the latest development in Shuttle less looms	6a. Describe advantages and disadvantage of Multiphase weaving 6b. Explain working principle of Triaxial weaving 6c. Explain latest developments in unconventional loom	6.1 Multiphase Weaving 6.2 Triaxial weaving 6.3 Latest developments in unconventional loom

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Preparatory Processes for Shuttle less Weaving**	06	2	4	2	8
II	**Weft Insertion by Projectile**	08	2	6	6	14
III	**Weft Insertion by Rapier**	06	2	4	4	10
IV	**Weft Insertion by Air Jet**	08	2	6	6	14
V	**Weft Insertion by Water Jet**	06	2	4	4	10
VI	**Multiphase looms, Triaxial looms and the latest development in Shuttle less looms**	08	2	6	6	14
Total		**42**	**12**	**30**	**28**	**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) Literature survey for different shuttleless weaving m/c with model and specifications
b) Prepare sketches and model for Weaving motions on Projectile & Rapier Looms.
c) Label each part of Air Jet weaving m/c and write their functions.

d) Differentiate right hand & left hand rapier head.
e) Observe timing and setting of weft insertion system in Air Jet looms
f) Study warp way & weft way multiphase looms.
g) Visit to Industries for study of Shuttleless looms.
h) Identify important parts of Water Jet looms.
i) Study torsion bar mechanism on Projectile looms.
j) Identify important parts of rapier picking system.
k) Identify important parts of Triaxial weaving machine.
l) Prepare charts for different picking system used in Shuttless looms.

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 **14-15 *(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) **Projectile Weaving Machine :** Prepare the report of different projectile machines with their specifications.
b) **Rapier Weaving machine:** Prepare the report of Rapier weaving machines with their specifications.
c) **Air jet Weaving machine:** Prepare the report of Air jet weaving machines with their specifications.
d) **Water jet Weaving machine:-** Prepare the report of water jet weaving machines with their specifications.

e) **Multiphase weaving & Tri axial Weaving machine:-** Prepare the report of multiphase and tri-axial weaving machine with their specifications.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Handbook of weaving	Sabit Adanur	Woodhead Publishing ISBN-13 : 978-1587160134
2	Modern Developments in Weaving	Duxbury and Ray	Metuchen N.J. Textile Book Service ISBN-13 : 978-0900298110
3	Principle of weaving	Marks, R. and Robbinsons	The Textile Institute Manchester ISBN-13 : 978-0900739798
4	Weaving Technology and operations	Ormerod. A. and Sondhelm. W.S.	Butterworth and Co. ISBN-13 : 978-1870812764
5	Shuttleless loom	Vinscent	The Textile Institute ISBN-13 : 978-0904095326
6	Weaving machine, material and management	Talukdar, Sriramulu and Ajgaonakar	Mahajan Publishers Private Limited, Ahmedabad ISBN: 9788185401164
7	Industrial Practices in weaving Preparatory	Dr. Mukesh Kumar Singh	Woodhead Publishing India ISBN-13 : 978-9380308296

14. SOFTWARE/LEARNING WEBSITES

a) https://www.academia.edu/25992494/Projectile_Weaving_Machine_Mechanism_and_Working_Principle_of_Projectile_Weaving_Machine
b) **https://textilestudycenter.com/modern-techniques-weft-insertion-projectile-weaving-machine/**
c) **https://www.textileadvisor.com/2021/05/structure-and-working-principle-of-air_30.html**
d) **https://www.youtube.com/watch?v=sqchTLyS2W4**
e) **https://hexdome.com/weaving/triaxial/weaving/index.php**

15. PO-COMPETENCY-CO MAPPING

Semester VI	Modern weaving Technology (Course Code: 4362902)
	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 5 Project Management	PO 7 Life-long learning
Competency .	**Supervise fabric production by setting looms and maintaining process parameters on modern Looms.**						
CO a) Manage preparatory processes of shuttle less weaving process	3	2	3	2	2	2	2
CO b) Supervise weaving production equipment in weft insertion by projectile method	3	2	3	2		2	2
CO c) Supervise weaving production equipment in weft insertion by rapier method	3	2	3	2		2	2
CO d) Supervise weaving production equipment in weft insertion by Air Jet method	3	2	3	2	2	2	2
CO e) Supervise weaving production equipment in weft insertion by Water Jet method	3	2	3	2	2	2	2
CO f) Supervise weaving production equipment in weft insertion by multiphase and triaxial weaving	3	2	3	2		2	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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