GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

CourseTitle: Garment Manufacturing Technology
(Course Code: 4332901)

Diploma programme in which this course is offered	Semester in which offered
Textile Manufacturing Technology	Third

1. RATIONALE

Garment technology is one of the important domains of Textile industry. Now a day, the demand for readymade garments (RMG) has rapidly increased which has the combined advantage of economic pricing, high production rate, minimum waste generation and bulk production capabilities. To fulfill this demand, student must have the knowledge of Garment technology. This course is intended to provide knowledge of individual steps involved in garment manufacturing process. The complete process of garment manufacturing starting from fabric selection till packing of finished garment is covered in this course. Students will be able to develop essential skills for garment production through proper fabric selection, prepare efficient marker plan to minimize waste and selection of correct stitch, seam, sewing needle, sewing thread and sewing machine. They will also be able to set operation sequence and material handling. With the modernization, automation and development of technology, computer-based systems are readily becoming popular which are able to save time, human efforts and minimize cost of production. In this regard, the understanding of computer-controlled grading, planning, spreading, cutting process along with Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) in garment production is very important and has been covered in this course. Essential efforts are made to meet basic industrial needs through this course.

2. COMPETENCY

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

- **Apply knowledge of garment technology to manufacture garment as per specification.**

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) Select suitable fabric for garment manufacturing based on end use application.
b) Develop different design pattern, grading and marker plan involved in garment manufacturing process.
c) Select suitable sewing needle, sewing thread, feed mechanism, sewing machine, and seam based on fabric characteristics.
d) Apply knowledge of CAD/CAM and fusing technology for garment manufacturing.

e) Analyze the garment quality through various stages of inspection.

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 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) are thesub-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'*.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine the different quality parameters used for fabric selection during garment manufacturing.	I.	02*
2	Prepare grading of pattern from a given garment sample.	II.	02*
3	Prepare marker plan for a given garment.	III.	02*
4	Demonstrate manual and automatic spreading process sand write their features.	III.	02*
5	Describe different cutting machine and write their features.	III.	02*
6	Develop different types of seams and write their features.	IV.	02*
7	Develop different types of stitches and write their features.	IV.	02*
8	Demonstrate different types of feed systems and write their features.	IV.	02*
9	Demonstrate sewing process and identify the different parts of a sewing machine and discuss the function of individual parts.	IV.	02*
10	Demonstrate folding and packing of garment.	IV.	02*
11	Demonstrate different types of fusing process and write their features.	V.	02*
12	Demonstrate use of CAD/CAM in garment technology and write their advantages over manual method.	V.	02*
13	Demonstrate various garment finishing processes and write their features.	VI.	02*
14	Demonstrate process flow chart of Garment merchandising.	VI.	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 or circuit.	20
4	Follow safe practices.	10
5	Record observations correctly.	20
6	Interpret the result and conclude.	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

Thismajor equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical's in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	Spreading table(manual method ,hook)	4
2	Straight knife Cutter: Power operated straight knife machine, Blade size: 8" straight Knife, Cutting height more than 4 inches, blade with grinding attachment, Motor rpm: 1440 or more	5
3	Single needle lockstitch sewing machine : Single needle drop feed industrial lockstitch machine with motor, stand and table, complete unit, Auto lubrication, Number of needles: 01 for medium to heavy fabrics. sewing speed: 4000 stitches per minute, Stitch length: minimum 4.2mm or more.	6,7,8,9
4	CAD software for pattern engineering, grading and marker planning, should have following features: Faster pattern drafting, Digitizing and Plotting Options, Flexibility in grading, alteration & editing, Flexible tools so that patterns after grading can be unnested easily and user can make amendments to any of the patterns, Faster Grading, Error free Markers, Time saving options, Real consumption facts, Software supplied with 5 users, certified software.	2,3,12

7. AFFECTIVE DOMAIN OUTCOMES

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

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Follow safety precautions.
d) Practice environmentally friendly methods and processes.

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 teacherto focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
Unit – I Introduction to Garment Technology	1a. State the importance of Garment industry. 1b. Select fabric based on end use application. 1c. Explain stages of garment manufacturing. 1d. State the need of Grey fabric inspection. 1e. Explain the different fabric grading systems. 1f. Judge fabric quality with the help of fabric grading system. 1g. Select various garment trims and accessories.	1.1 Importance of garment industry in present Textile trends 1.2 Eco clothing in garment industry. 1.3 Factors affecting selection of fabrics in garment manufacturing. 1.4 Stages of Garment manufacturing process. 1.5 Fabric grey inspection method. 1.6 Fabric grading system. • Four-point grading system (American Four point grading system), 10 points system fabric inspection. 1.7 Various Garment trims and accessories.
Unit – II Pattern making and Grading process	2a. Select suitable design pattern for garment manufacturing. 2b. Perform grading of pattern.	2.1 Pattern design, Sample making. 2.2 Grading of pattern. 2.3 Methods of pattern grading.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
Unit– III Marking, Spreading and Cutting process	3a. Prepare Marker planning. 3b. Differentiate between manual and automatic spreading process. 3c. Identify different types of cutter.	3.1 Requirements of marker planning. 3.2 Efficiency of marker plan. 3.3 Methods of marker planning. 3.4 Requirements of spreading. 3.5 Methods of spreading manual and automatic. 3.6 Modes of spreading based on nap and face direction. 3.7 Types of fabric packages. 3.8 Objectives of cutting process. 3.9 Methods of cutting and their features.
Unit- IV Sewing process	4a. State objects of sewing. 4b. Explain different types of seams and stitches. 4c. List seam properties. 4d. Identify sewing problems. 4e. Identify different parts of a sewing machine and the functions performed by individual parts. 4f. Identify types of sewing threads. 4g. Describe different types of feed mechanism. 4h. Select sewing machine needles.	4.1 Objectives of sewing process. 4.2 Properties of seams. 4.3 Types of seams, their features and applications. 4.4 Types of stitch. 4.5 Different problems arise during sewing process. 4.6 Test methods to access quality of seam. 4.7 Different types of sewing threads and their features. 4.8 Basic sewing machine and function of different parts. 4.9 Sewing machine work aids. 4.10 Different types of feed mechanism and their features. 4.11 Different types of sewing machine needles and their features.
Unit– V CAD/CAM and Fusing Technology	5a. Compare manual garment manufacturing process and CAD/CAM based garment manufacturing. 5b.Describe Computerized grading, marker planning and cutting. 5c. Explain fusing process.	5.1 Compare Manual Vs CAD/CAM based garment manufacturing process. 5.2 Advantages of CAD/CAM. 5.3 Computerized grading and marker planning. 5.4 Computer controlled cutting process. 5.5 Requirement of Fusing process. 5.6 Types of Fusing process.
Unit – VI Role of Garment Analysis & Merchandising in Garment Industry	6a. Distinguish between intrinsic and extrinsic parameters of garment. 6b. Describe the various stages of garment inspection process. 6c. Test methods for garment final inspection. 6d. Explain stages of garment finishing processes. 6e. Describe process flow chart of Garment merchandising.	6.1 Intrinsic and extrinsic parameters of garment. 6.2 Garment analysis, methods and process of garment analysis. 6.3 Inspection of raw materials : sewing threads, construction and sewability, trims inspection- zippers waist band, buttons, interlining. 6.4 Inspection in process: spreading, cutting, sewing quality parameter and types of defects occurring, assembly defects. 6.5 Final inspection: finishing defects,

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
	6f. Describe the role and responsibilities of merchandiser in garment industry.	100% inspection, spot checking, and arbitrary sampling. 6.6 Final Testing: Color fastness, Stability, shrinkage, and extension recovery, abrasion, pilling or snagging, flammability. 6.7 Stages of various garment finishing processes. 6.8 Process flow chart of Garment merchandising. 6.9 Merchandising: type of Merchandiser, responsibilities of merchandisers, modern retailing by Merchandiser.

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	Introduction to Garment Technology	04	2	3	2	07
II	Pattern Making and Grading Process	03	2	3	2	07
III	Marking, Spreading and Cutting process	10	4	6	6	16
IV	Sewing Process	10	4	8	6	18
V	CAD/CAM and Fusing Technology	06	2	5	3	10
VI	Role of Garment Analysis & Merchandising in Garment Industry	09	2	6	4	12
Total		**42**	**16**	**31**	**23**	**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 theUOs. 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 small reports of above 5 page for each activity,also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare a chart showing different fabric selection criteria for Garment manufacturing.
b) Prepare marker plan for different types of Garments.

c) Prepare a chart showing different types of seams and stitches.
d) Present a seminar on any relevant topic of Garment technology.
e) Explore library/internet to understand production technologies being used for garment manufacturing and prepare a report.
f) Prepare showcase portfolios of various cutting, spreading, and sewing machine.
g) Internet survey regarding uses of different sewing work aids used in Garment industry.

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-projects 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 microproject 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 should relate highly with competency of the course and the COs.Similar micro-projects could be added by the concerned course teacher:

a) **Fabric selection**: Study the parameters related to fabric selection and prepare a report.
b) **Eco clothing**: Study the parameters related to eco clothing and prepare a report.
c) **Pattern Making and Grading**: Prepare a miniature marker plan and grading for different types of garments.
d) **Cutting:** Prepare a detailed report on different cutting machine their features.

e) **Sewing:** Prepare a report on sewing machine and sewing quality process parameters.
f) **Role of garment analysis:** Study the parameters related to role of garment analysis and prepare compile report.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Garment Technology clothes	Carr & Lathan	Black well publisher, England
2	Stitches & Seam	R.M. & Webster J	Laing ISBN : 1870812735
3	Clothing Technology from fibre to Fashion	Kilgus R.	ISBN: 3808562218
4	Cutting & draping occasion clothes	Clooke	ISBN : 0713483326
5	Introduction to clothing manufacture	Cooklin	ISBN : 063202618
6	An introduction to quality control for the apparel industry	Mehta P.V.	ISBN:0824786793
7	Apparel Manufacturing Handbook	Jacob Solinger	Van Nostrand Reinhold Company, 1988.

14. SOFTWARE/LEARNING WEBSITES

a) http://nptel.ac.in/
b) http://www.textileassociationindia.org/
c) http://www.sitra.org.in/
d) http://www.itamma.org/
e) https://textilestudycenter.com/
f) http://www.textileschool.com/
g) https://textilestudycenter.com/textile-books-free-donwload/
h) http://textilelearner.blogspot.in/
i) https://garmentsmerchandising.com/
j) https://www.onlineclothingstudy.com/
k) https://youtu.be/w8xiBtK0Ca0
l) https://www.slideshare.net/

15. PO-COMPETENCY-CO MAPPING

Semester II	Garment Manufacturing Technology (Course Code: 4332901)
	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	Apply knowledge of garment technology to manufacture garment as per specification.						
Course Outcomes CO a) Select suitable fabric for garment manufacturing based on end use application.	2	2	-	2	3	1	2
CO b) Develop different design pattern, grading and marker plan involved in garment manufacturing process.	3	1	2	-	2	2	3
CO c) Select suitable sewing needle, sewing thread, feed mechanism, sewing machine, and seam based on fabric characteristics.	2	2	-	1	2	2	3
CO d) Apply knowledge of CAD/CAM and Fusing Technology for garment manufacturing.	3	2	3	-	1	2	2
CO e) Analyze the garment quality through various stages of inspection.	2	-	1	3	2	1	2

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

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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