GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Textile Manufacturing Technology / Textile Designing

Subject Code : DI04000341

Subject Name : Smart and E-Textiles

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	MOPEC

Prerequisite:	Basic knowledge of high-performance fibers, electronic and communication technology and fabric manufacturing process
Rationale:	Throughout history, clothing has primarily served the purpose of protecting individuals from cold and rain. However, over time, the aesthetic aspect of clothing gained significance. A new generation of intelligent fabrics has emerged, offering many possibilities. The field of interactive textiles in the textile industry is relatively new, involving active materials with sensing and actuation capabilities. In recent years, the demand for smart materials and intelligent textiles has increased globally due to their ability to provide superior performance for a wide range of applications, including the military, healthcare, sportswear, fashion, and other fields. In future, integrated electronic devices are expected to be an essential component in garments for providing information about ourselves during our daily lives, by enabling wearable computing.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the functions, classification and applications of smart textile.	R, U, A, N
02	Understand the fibers and intelligent material use in smart textile.	R, U, A, N
03	Understand the sensors and ink use in smart textile.	R, U, A, N
04	Select relevant fibre and fabrication method to produce E- Textiles.	R, U, A, C
05	Evaluate the future scope of smart and E-Textiles.	R, U, A, E

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	0	3	70	30	00	00	100

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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1. Introduction of Smart Textile	1.1 History of Smart Textiles development 1.2 Objectives for Smart Textiles 1.3 Classification of Smart Textiles 1.4 Application of Smart Textiles	6	14
2. Fibres and Intelligent materials in Smart textiles	2.1 **Types of fibers**: Metal fibres, Optical fibres 2.2 **Intelligent materials**: Coating with nanoparticles, Shape memory materials, inherently conductive polymers, electrically conductive textiles 2.3 **Chromic materials:** Thermochromic material, Electrochromic material, Photochromic material, Phase-change materials, Piezoelectric textiles	10	24
3. Sensors and Inks in smart textiles	3.1 **Types of sensors**: Wearable sensors, biological sensors 3.2 **Types of conductive inks**: Silver-based conductive ink, Copper-based conductive ink, Carbon-based conductive ink, Nickel-based conductive ink, Graphene-based conductive ink	9	20
4. E- Textiles	4.1 Introduction to E - Textiles 4.2 **Materials used for E–Textiles**: Metals and metallic nanoparticles, Conductive Polymers, Carbon based material 4.3 **Fabrication methods used for E-Textiles**: Spinning methods, Chemical Solution/vapour polymerization, Coating method, Knitting and Weaving, Embroidery, Braiding, Printing, Conductive adhesives, Non-woven fabrics 4.4 Emerging Application of E- Textiles	12	24
5. Future of Smart and E- Textiles	5.1 Latest development in smart textiles and E- Textiles 5.2 Challenges & limitations of Smart Textile 5.3 Environmental concerns in Smart Textiles 5.4 Industry trends and future opportunities 5.5 Challenges and futures of E-Textiles	8	18
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**35**	**25**	**10**	**05**	**05**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Md Raihan Hossain, Md Raju Ahmed & Md Shamim Alam (2023) Smart textiles, Textile Progress, 55:2, 47-108, DOI: 10.1080/00405167.2023.2250651
2. Melse Firew Adamu, Tamrat Tesfaye, Baye Berhanu & Abdella Simegnaw (2025) Electronic textiles, Textile Progress, 57:1, 1-71, DOI: 10.1080/00405167.2025.2468595

(b) Open source software and website:

1. https://textilelearner.net/electronic-textiles/
2. https://www.mdpi.com/1424-8220/22/16/6055
3. https://www.intechopen.com/chapters/1155564
4. https://www.loomia.com/blog/passive-vs-active-smart-textiles
5. https://apparelresources.com/technology-news/retail-tech/smart-wearable-e-textiles-international-fablabs/

List of Laboratory/Learning Resources Required:

Suggested Project List:

1. Prepare a detailed report on types of sensors used in Smart Textiles.
2. Prepare a detailed report on material used in E Textiles.
3. Study the parameters in fabrication methods of E Textiles.
4. Prepare a chart for different application of Smart and E Textiles.
5. Prepare comprehensive reports on Environmental concerns in Smart and E Textiles.

Suggested Activities for Students:

1. Explore wearable circuits and e-textiles by sewing a circuit and LEDs into ordinary gloves.
2. Prepare showcase portfolios of various sensors used in Smart Textiles.
3. Internet survey regarding latest development in the area of Smart and E Textiles.
4. Present a seminar on any relevant topic of Smart and E Textiles.
5. Plan field trips to Smart and E Textiles manufacturing facilities or research association.

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