GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code:3172615
Semester – VII
Subject Name: Liquid Crystal Elastomers

Type of course: Professional Elective Course-VI

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content

Sr. No.	Content	Total Hrs
1.	**Preparation of Liquid Crystalline Elastomers:** Introduction, Synthesis of LC Polymer Networks, Side Chain Elastomers, Main Chain Elastomers, Basic Characterization of LC Networks.	06
2.	**Mechanical Orientation Behavior:** Introduction, Chain Conformation of Linear Polymers, Orientation of Polydomain Networks.	06
3.	**Liquid Single Crystal Elastomers:** Permanent Orientation of the Main Axis, Coupling to the Chain Anisotropy, Coupling to LC Properties, More Complex Orientation Methods, Orientation of the Second Director, Orientation of the Layer Normal in SC LSCEs.	06
4.	**Applications of Liquid Crystalline Elastomers:** Introduction, Preconditions for Selecting LC Elastomers, Actuators Powered by a Phase Transition, Designing Actuators with Defined Specifications, Introduction of Actuator Systems, LC Elastomer Devices.	08
5.	**Liquid Crystal Elastomers in Electric Fields:** Ferroelectric Liquid Crystals and Their Networks, Preparation of FLCEs, Electromechanical Properties of FLCEs.	06
6.	**Liquid Crystal Elastomers and Light:** Introduction, Orientational Order, Elasticity, Liquid Crystal Elastomers	06
7.	**The Effects of LCEs on Light:** Refractive Indices, Polydomain LCEs, Gels, and LC Networks, Lasing in Cholesteric LCEs, Optical Properties of Cholesterics, Distributed Feedback Lasing in Cholesteric LCEs, Non-lasing Applications.	07

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Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	15	10	10	10	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

- Liquid Crystal Elastomers: Materials and Applications, Editor: Wim H. de Jeu, Published by Springer
- Liquid Crystal Elastomers by M.Warner and E. M. Terentjev, Published by Oxford Science publications
- Crosslinked Liquid Crystalline Systems, Editors: Dirk J. Broer, Gregory P. Crawford, Slobodan Zumer, Published by CRC Press

Course Outcomes:

After learning this course students will be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Classify the synthesis of liquid crystal elastomers	10
CO-2	Explain the orientation behavior of liquid crystal elastomers	15
CO-3	Identify and Analyze applications of liquid crystal elastomers	15
CO-4	Justify the use of liquid crystal elastomers in electric fields	15
CO-5	Relate liquid crystal elastomers and light	15

List of Open Source Software/learning website:

- https://en.wikipedia.org/wiki/Liquid_crystalline_elastomer
- http://www.lcelastomer.org.uk/
- http://www-f1.ijs.si/~rudi/sola/Seminar-mehka.pdf