

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: Under Graduate

Branch: Rubber Technology

Subject Code : BE03026031

Subject Name : Latex Technology



w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	PCC

<b>Prerequisite:</b>	None
<b>Rationale:</b>	<p>The Latex Technology subject offers an in-depth exploration of natural rubber latex, from its biological origins to its complex industrial applications. Covering topics such as the cultivation of latex, colloidal science, preservation methods, and latex compounding provides students with a comprehensive understanding of latex as a material. Furthermore, the inclusion of topics like latex allergy ensures that students are aware of the health and safety concerns associated with latex products, which is crucial in industries such as healthcare and food handling.</p> <p>This course bridges the gap between basic material science and industrial applications, allowing students to develop the practical skills needed for careers in latex product development, manufacturing, and quality control. By focusing on the science behind latex properties, processing methods, and applications, the course prepares students to meet the challenges of industries that rely on latex and its derivatives. Additionally, students gain the ability to innovate in creating new latex formulations, developing sustainable alternatives, and ensuring product safety and efficacy.</p>

## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Explain the factors affecting the yield of latex and their influence on latex production.
02	Apply the techniques for preparing solutions, dispersions, and emulsions required for latex compounding.
03	Analyze and differentiate the colloidal systems and explain the gelation mechanism in natural rubber latex.
04	Evaluate and diagnose the causes of latex allergies and propose mitigation strategies.

## Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	60	15	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

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\* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.

## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Cultivation of Natural Rubber Latex: The principal rubber tree: General description, more detailed structure of the mature trunk, The Hevea brasiliensis plantations: Conditions required for the growth of Hevea brasiliensis, Regions of the world where Hevea brasiliensis is found, outline of the history of the Hevea brasiliensis plantations, Propagation of Hevea brasiliensis: Introduction, Propagation by seed, Vegetative propagation.	04	10
2.	Natural Lattices : Tapping: Introduction, Early tapping system, modern tapping system, factors which affect the yield of latex & rubber, other methods of tapping, improvement of latex yield, Redispersible natural rubber from natural rubber latex.	04	10
3.	Preservation of Natural Rubber Latex: Preliminary considerations, The ideal preservative for natural rubber latex, Ammonia as a preservative, Ammoniation, Low-ammonia preservation system, other preservative for natural rubber latex.	04	10
4.	Concentration of Natural Rubber Latex: Preliminary considerations, Concentration by evaporation, creaming, centrifugation and electrodecantation, Properties of natural rubber latex concentrates.	04	10
5.	Colloid Science: Colloidal Dispersions, Stability of Colloidal Dispersions, Types of Colloidal Solution, Preparation and general characteristics of Colloidal Solution, Dialysis, Electrical Properties of colloidal systems, Electrophoresis of Lattices, Thermal measurement of molecules, kinetics of Brownian motion, Association Colloids, Gels, Emulsions, Applications of Colloids.	07	20
6.	Fundamental Latex Characteristics & Its Gelation: Particle size & distribution, Stability & destabilization of lattices, viscosity, concentration relationship, surface free energy & wetting behavior, zeta- potential, Zinc oxide solubility with pH, Significance of Gelation, Heat gelling systems, Delayed action gelling system, significance of pH/time gelation cure.	07	10
7.	Latex Compounding Ingredients: Introduction, Rubber vulcanizing agents, rubber vulcanization accelerators, rubber vulcanization activators, rubber anti-oxidants, fillers	06	10

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	and pigments, surface active substances, viscosity-modifiers and macromolecular colloid stabilizers, other latex compounding ingredients.		
8.	Preparation of Solutions, dispersions and emulsions for Latex Compounding: General considerations, Preparation of aqueous solutions for addition to latices, Preparation of aqueous dispersions of solid latex compounding ingredients, preparation of oil -in-water emulsions for addition to latices, representation of latex formulations.	05	10
9.	Latex allergy: Introduction, causes, remedies, types of latex reactions and allergy, Diagnosis of latex allergy, management of latex allergies etc.	04	10
	<b>Total</b>	<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	20	10	10	10

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. Natural Rubber Science & Technology By: Roberts.
2. Hand book of Rubber Projects, Tech. & Product Formulary. By: SBP Consultants & Engineers (P) Ltd.
3. Polymer Latices Vol. 2 by D. C Blackley.
4. Polymer Latices Vol. 3 by D. C Blackley.
5. Rubber Engineering, IRI

### (b) Open source software and website:

- [www.sculpt.com/catalog\\_98/CastingMaterials/LATEX/latex.htm](http://www.sculpt.com/catalog_98/CastingMaterials/LATEX/latex.htm)
- [material.eng.usm.my/stafhome/.../Week%205%20Elastomer\(rubber\).ppt](http://material.eng.usm.my/stafhome/.../Week%205%20Elastomer(rubber).ppt)
- [www.mambaby.com/uploads/tx\\_dddownload/Latex\\_Report.pdf](http://www.mambaby.com/uploads/tx_dddownload/Latex_Report.pdf)
- [shodhganga.inflibnet.ac.in/bitstream/10603/70533/7/07\\_chapter%201.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/70533/7/07_chapter%201.pdf)

## Suggested Course Practical List: If any

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Practical based on above topics.

## **List of Laboratory/Learning Resources Required:**

### **Suggested Project List:**

1. **Sustainable Cultivation Practices for Enhancing Latex Yield in Rubber Plantations**
2. Comparative Study of Natural Lattices: Properties and Industrial Applications
3. Development of Eco-Friendly Preservatives for Natural Rubber Latex
4. Optimization of Centrifugation and Evaporation Processes for Latex
5. Stability and Gelation Mechanisms in Natural Rubber Latex Colloidal Systems
6. Effect of Crosslinking and Vulcanization on the Gelation of Natural Rubber Latex
7. Formulation of Latex Compounding Ingredients for Enhanced Mechanical Properties
8. Optimization of Emulsions and Dispersions for Latex Compounding
9. Reduction of Allergenic Proteins in Natural Rubber Latex for Medical Applications
10. Recycling of Latex Products: Methods and Challenges
11. Development of Biodegradable Latex Compounds for Eco-Friendly Applications

### **• List of suggested activities for Problem Based Learning:**

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Online Course	Minimum duration of the course should be 20 h.	Based on assignment submitted and certificate produced.
2.	Virtual Industry Trip	Duration of hours-5h Report preparation- 5h Total -10 h	Based on report submitted. Report should contain manufacturing process, flow chart.
3.	Self-Learning Through Assignment Creation related to subject	Completion of five independent tasks, each designed for a 3-hour engagement. Total = 15h	Based on assignment submitted.
4.	Case Study Analysis related to subject	Duration of data collection -6 h Report preparation – 4h	Based on Problem identification, depth of analysis, technical insight, application relevance

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		Total- 10 h	
5.	Technical Article/Video Reviews related to subject	Duration of Review -6h Report preparation -4h Total-10h	Relevance of content, clarity of summary, insights drawn, conceptual understanding
6.	Literature review and Concept Mapping	Duration -6h Report preparation- 4h Total-10 h	Based on selection of a topic, creation of concept map, Accuracy, structure, completeness, clarity and coverage of key concepts
7.	Field Visit to Industrial or Research Setup	Visit- 5h Report preparation-5h Total-10h	Based on report submitted. Report should contain manufacturing process, plant layout, testing results.
8.	Industry Interaction (Webinar/Interview/Quiz)	Total-10 h	Based on certificate produced for participation in webinar, interview, quiz and based on report submitted. Report should contain key takeaways.
9.	Industry Trend Analysis and Blog Creation	Total – 10 h	Based on report and blog submitted. Report should contain current, real-world and research emerging trends. Blog should contain 500-1000 word with peer feedback or comments.
10.	Peer Teaching Video	2 video preparation -10 h	Create a 5–10-minute video explaining a rubber technology concept for peers, incorporating visuals.
11.	Glossary Compilation	Duration -5h	Based on report submitted. Report should contain Accuracy, completeness, formatting, and use of illustrations/examples
12.	Visual presentation of technical content through posters, charts, or PowerPoint slides	Duration = 10 h	Based on quality of poster/chart preparation, creativity, accuracy and effectiveness of presentation skills.

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13.	Model-making (working or non-working) focused on technical concepts	Duration -15 h	Based on evaluation from inter-department or external experts.
14.	Industrial exposure for 2–3 days to analyze practical problems and recommend possible solutions in areas such as society, environment, health, or similar fields.	Duration = 15 h for industrial exposure  Problem identification and tentative solution = 10 h Total = 25 h	Evaluation based on depth of problem analysis and the relevance of the solutions provided.

## Note:

- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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