

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E.in Rubber Engineering

Semester: I

Subject Name: **The Physics of Rubber Elasticity**

Subject Code: **714001**

Sr. No	Course Content
1	General Physical Properties of Rubber: Chemical constitution of rubbers, Early theories of Rubber Elasticity, The Kinetic theory of Elasticity, Cross-Linking and Vulcanisation: network theory, The glass-rubber transition, Crystallization in raw rubber, Crystallization in the stretched state, Photoelastic Properties of Rubbers etc.
2	Internal Energy and Entropy Changes on Deformation: Stress-temperature relations, Thermodynamic analysis, Application to experimental data, Interpretation of thermoplastic data, Thermal effects of extension.
3	The Elasticity of Long-Chain Molecules: Statistical Properties of Long-chain molecules, Statistical form of Long-chain molecule, The randomly jointed chain, Properties of Gaussian functions, The distribution of r-values, Equivalent random chain. The entropy of a single chain, the tension on a chain.
4	The Elasticity of a Molecular Network: The nature of the problem, Detailed development of the theory, Significance of theoretical conclusions, The principal stresses, Significance of single elastic constant, The elastic properties of a swollen rubber, Development of the theory by James and Guth, Network imperfections : 'loose end' corrections.
5	Experimental Examination of The statistical Theory: Introduction, Particular stress-strain relations, Experimental examination of stress-strain relations, Derivations from theory: Mooney equation, Non-Gaussian Chain Statistics and Network Theory, Thermodynamic Analysis of Gaussian Network etc.
6	Swelling Phenomena: Introduction, General Thermodynamic Principles, Significance of thermodynamic quantities, Statistical treatment of Swelling, The Swelling of Cross-linked polymers, Relation between swelling and modulus, The Cohesive-energy density, The dependence of swelling on strain, Swelling under torsional strain, etc
7	Cross linking and Modulus: Introduction, The experiments of Moore and Watson and of Mullins, Effect of entanglements etc.

Text Book:

1. The Physics of Rubber Elasticity by L.R.G.Treloar.

Reference Book:

1. Viscoelastic Properties of Polymers by John D.Ferry.