



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3132306

Semester – III

Subject Name: Applied mathematics in Plastic Industry

Type of course: Basic Science Course

Prerequisite: -

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	2	0	5	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Basic concept of Stress and Strain, modulus, Ideal elastic solid, pure viscous flow	02
2	Mechanical behaviour of plastics : Stress Strain behaviour of plastic materials, long term and short term tests, creep behavior , Design methods for plastics using Deformation Data, Isometric and Isochronous graphs , Pseudo- elastic design method for plastics, beam calculations, Thermal stresses and strains. The concept of stress concentration, General fracture behavior of Plastics	15
3	Viscoelastic models : Viscosity, Generalized Hook’s and Newtons law, Maxwell Model, Kelvin Voigt Model, Complex models, Burger model, Zener model, Creep Curves, Numericals related to these models. Deformation behavior of polymeric materials.	10
4	Analysis of polymer melt flow: General Behaviour of plastic melts, Isothermal flow in channels [Non Newtonian Fluids] , Rheological models of Polymer melt flow , Elastic behavior of Polymer melt, Swelling ratios due to shear stress / tensile stresses, Experimental methods to obtain flow data[Cone and plate viscometer , Concentric Cylinder Viscometer , Ram Extruder] , Analysis of heat transfer during Plastic Processing.	10
5	Mechanical behavior of composites: Deformation behavior of reinforced plastics, Types of reinforcement and matrix, Aspect ratio, Analysis of continuous fibre composites -longitudinal Properties- Properties parallel to longitudinal axis	05



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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15%	35%	25%	10%	10%	05%

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:

1. Plastics Engineering by R.J.Crawford [2nd Ed.] , Pergamon Press.
2. Polymer Science by V.R.Gowariker and N.V.Viswanathan, Willey eastern limited.
3. Polymer Science and Technology by Premamoy Ghosh, Tata McGraw Hill
4. Polymer Science and Technology by Robert O. Ebewele
5. Polymer Viscoelasticity: Stress and Strain in Practice by Evaristo Riande.

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Define stress, strain and modulus.	05
CO-2	Understand the stress strain behavior of plastic materials	20
CO-3	Describe Maxwell and Voigt model for viscoelasticity.	20
CO-4	Apply rheological models of polymer melt flow.	20
CO-5	Analyze heat transfer during plastic Processing.	20
CO-6	Explain longitudinal properties in continuous fiber composites	15

List of Experiments: - As per the above syllabus topics-

List of Open Source Software/learning website:

1. www.viscoelasticity.info
2. <https://nptel.ac.in>