PLPC3002 PLASTICS TESTING TECHNIQUES (3-0-0)

Course objective:

The course aims to equip students with comprehensive knowledge of standards, specifications, and testing of plastic materials. Students will gain practical skills in preconditioning test specimens, conducting various property evaluations, and understanding sectorial testing standards. Additionally, the course covers product-specific testing, failure analysis, and characterization techniques such as DSC, TGA, and FTIR, as well as principles of non-destructive testing.

Syllabus

Module-I

Standards, specifications and testing

Standard and specification-National and International Standards-Test specimen preparation preconditioning and test atmosphere.

Mechanical Properties: Hardness-tensile strength-compressive strength-shear strength-flexural strength-heat strength-impact strength-dynamic stress-strain properties-creep-relaxation and set tests friction and wear-abrasion test-fatigue-burst strength-and folding endurance.

Thermal Properties: Specific heat and thermal conductivity thermal dependent properties- thermal endurance-glass transition temperature-thermal yield tests-Heat deflection temperature- Vicat softening temperature- Marten's heat resistance test-low temperature brittle point and flexibility test- coefficient of thermal expansion-shrinkage-Thermal stability-Thermal ageing and flammability.

Module-II

Optical and electrical properties

Optical Properties-Refractive index-light transmission-haze-clarity-gloss-colour guard and microscope. Electrical Properties-Insulation resistance-power factor-permittivity – dielectric strength-tracking resistance-arc resistance and antistatic test.

Permeation properties: Water absorption-soluble and insoluble matter-chemical resistance environmental stress cracking resistance-ageing-gas permeability-water vapour permeability and weathering. Knowledge and exposure on Sectorial Testing Standards

Preconditioning and test atmosphere - Testing of Mechanical, Thermal, Optical, Electrical properties, Permeability Properties and Rheological properties.

Module-III

Product testing

Pipe and fittings-film and sheets-container testing and FRP based products. Factors for designing tests for newer products- Factors affecting the quality of materials and products analysis of failure and its measurements

Techniques of characterization-Principles and application of DSC- TGA and FTIR, concepts of nondestructive testing

Course outcomes:

After the completion of this course, students will be able to:

CO1: Understand: advanced product testing techniques such as mechanical, optical, thermal, and permeation analysis.

CO2: Perform experimental techniques for measuring the properties of polymers products.

CO3: Understand: Able to explain the knowledge in mechanical behavior of polymers.

CO4: Analyze: Describe the polymer properties of polymers with respect to their chemical structures.

CO5: Design: designing test for newer products.

Books

1. Hand Book of Plastics Testing Technology, Shah, Vishnu, John Wiley and Sons, SPE Monograph(1984)
2. Hand Book of Polymer Testing, Brown; Roger P (Ed.), Marcel Dekker, Inc, New York (1999)
3. Hand Book of Plastics Technology 2 vol. By Allen, W.S & Baker P.N

Reference Books

1. Plastic Engineering Hand Book & D-5 By Society of Plastics Industry Inc
2. Brown; Paul F (Ed), Hand Book of Plastics Test Methods, Longman Scientific and Technical, Harlow88
3. Blythe;A. R, Electrical Properties of Polymers, Cambridge University Press, Cambridge (1979).
4. Electrical Properties of Polymers, Blythe;Tony and Bloor; David, 2nd Ed, Cambridge Press
5. Plastic Engineering Hand Book & D-5 By Society of Plastics Industry Inc
6. Mitcheli Jr.; John, Applied Polymer Analysis and Characterization-Recent Development in Techniques, Instrumentation, Problem Solving, Hanser Publishers