

**SEMESTER –IV**  
**BSc. (Polymer Science)**  
**Bhaskaracharya College of Applied Science**

**DISCIPLINE SPECIFIC CORE COURSE – 10**

**CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE**

| Course title & Code                             | Credits  | Credit distribution of the course |          |                     | Eligibility criteria  | Pre-requisite of the course (if any) |
|---|----------|-----------------------------------|----------|---------------------|---|--------------------------------------|
|   |          | Lecture                           | Tutorial | Practical/ Practice |   |                                      |
| <b>POLYMER TESTING AND SPECIFICATIONS (PTS)</b> | <b>4</b> | <b>2</b>                          | <b>0</b> | <b>2</b>            | <b>Class 12<sup>th</sup> with Physics, Chemistry, Mathematics</b> | <b>NIL</b>                           |

**Learning objectives**

The Learning Objectives of this course are as follows:

- To learn about the fundamentals of polymer testing
- To understand testing standards of polymeric materials on various testing instruments

**Learning outcomes**

The Learning Outcomes of this course are as follows:

After completing the course, the students

- Perform tests of polymeric materials on testing instruments
- Establish the structure property correlation (mechanical, thermal, optical, electrical) of polymers
- Elucidate stability of various polymers and their properties on the basis of their thermo mechanical transitions.

**SYLLABUS OF DSC- 10**

**THEORY COMPONENT-**

**UNIT 1:**

**(12 Hours)**

**TESTING STANDARDS AND MECHANICAL ANALYSIS OF POLYMERS**

Principles of standardization, preparation of sample, different standards: BIS and ASTM standards (thermal and mechanical analysis), testing methods, evaluation of errors in polymer testing, correction of errors

- a. Short term strengths: tensile, flexural, hardness, impact strength, tear resistance, abrasion, etc.
- b. Long term strengths: Creep and fatigue properties, isochronous stress strain curve compression set.

## **UNIT 2:**

**(4 Hours)**

### **ELECTRICAL AND OPTICAL PROPERTIES**

Dielectric strength, surface and volume resistivity, electro active properties, Refractive index, Haze and gloss, yellowness index.

## **UNIT 3:**

**(6 Hours)**

### **GAS BARRIER AND ENVIRONMENTAL ASSESSMENT**

Permeability to gases and moisture: Standard methods of measuring the permeability of gases, Environment resistance: Cause of deterioration of polymer by aging & weathering, assessment of deterioration, natural and artificial weathering, chemical resistance.

## **UNIT 4:**

**(8 Hours)**

### **THERMAL AND FIRE RESISTANT PROPERTIES**

Thermo-mechanical Properties, Melt flow index, thermal conductivity, thermal diffusivity, specific heat capacity, linear thermal expansion, brittleness temperature etc. Burning behaviour, flammability tests (UL-94, limiting oxygen index, critical temperature index, smoke density).

## **PRACTICAL COMPONENT**

**(60 Hours)**

- To determine the melt flow index of LLDPE, PP etc.
- To evaluate limiting oxygen index (LOI)/ UL-94 of plastic samples: PVC, PE, PP etc.
- To determine the heat distortion temperature (HDT) & vicat softening point (VSP) of polymers.
- To measure the abrasion resistance of polymer sheets.
- To measure the dielectric strength of polymer films/sheets.
- To determine the coefficient of friction of polymeric samples.
- To determine the Izod impact strength of polymeric samples.

- To determine the environment stress cracking resistance of PE/PP.
- To calculate weight percentage of inorganic and organic ingredients in polymeric compounds.
- Measure the Thermo-mechanical transition.
- Determine the water vapor transition rate for polymeric film.
- Determine the thermal conductivity of a polymer sheet.

### ESSENTIAL/RECOMMENDED READINGS

- Shah V., (2007) Handbook of Plastic Testing & Technology, Wiley-Inter science.
- Hylton D., (2004) Understanding Plastic Testing, Hanser publication
- Grellmann W., Seidler S., (2013) Polymer Testing, Hanser publication.
- Willard H.H., Merrit L.L., Dean J.A. (1988) Instrumental method of analysis, Wadsworth Publishing Company.
- Seidel, A. (Ed.). (2008). Characterization analysis of polymers. Wiley-Interscience.
- Pethrick, R. A., & Viney, C. (2003). Techniques for polymer organization and morphology characterisation. Wiley.
- Frick. A., Stern. C. , Muralidharan V. (2019) Practical Testing And Evaluation Of Plastics, Wiley,

### SUGGESTIVE READINGS

- Berins M. L., (1991) SPI Plastic Engineering Hand book, Springer.
- Ward I.M., Sweeney J., (2004) An Introduction to the Mechanical Properties of Solid Polymers, Wiley.
- Tanaka T., (1999) Experimental Methods in Polymer Sciences, Academic Press.

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.