



# INTRODUCTION TO POLYMER SCIENCE

## **PROF. DIBAKAR DHARA**

Department of Chemistry  
IIT Kharagpur

**PRE-REQUISITES** : Basic knowledge of Chemistry (1st year level)

**INTENDED AUDIENCE** : Chemistry; Chemical Engineering; Material Science and Engineering; Physics; Polymer Science and Technology

**INDUSTRIES APPLICABLE TO** : SABIC; Solvay; Asian Paints, Hindustan Unilever; Shell; Dupont; BASF ;Reliance; ITC, Tata Chemicals; Dow Chemicals, GM and many others.

## **COURSE OUTLINE :**

This course will educate the students on the subject of polymers that constitute one of the most important materials used presently. The course will include fundamentals of synthesis, characterization, properties and also include discussion on the applications of polymers, as well as challenges pertaining to contemporary polymer research.

## **ABOUT INSTRUCTOR :**

PROF. DIBAKAR DHARA, After completing B.Sc. (Hons.) and M. Sc. in Chemistry from Jadavpur University, Kolkata, Prof. Dibakar Dhara carried out his doctoral research at Indian Institute of Chemical Technology, Hyderabad. He had couple of year of postdoctoral research experience at Department of Chemical Engineering, University of Florida, Gainesville, Florida before joining as Polymer Engineer at General Electrics Global Research Centre at Bangalore. After spending nearly seven years at GE, he moved to IIT Kharagpur as a faculty in Chemistry department where he is working for last eleven years. His present research interests are in the following topics Polymer Synthesis, Physical Chemistry of Polymers, Colloids and Nanomaterials.

## **COURSE PLAN :**

**Week 1:** Introduction: Background, Nomenclature, Classifications, Molecular Weight, Examples of Applications, Principles of Polymerization

**Week 2:** Synthesis of Polymers: Step-Growth Polymerization, Radical Chain Polymerization

**Week 3:** Synthesis of Polymers: Radical Chain Polymerization, Controlled Radical Polymerization Emulsion Polymerization.

**Week 4:** Synthesis of Polymers: Ionic Chain Polymerization, Coordination Polymerization, Ring-Opening Polymerization, Copolymerization

**Week 5:** Characterization of Polymers: Polymers in Solution, Chain Dimension, Determination of Molecular Weight

**Week 6:** Determination of Molecular Weight (cont.), Frictional Properties of Polymers in Solution, Hydrodynamic Size, Chemical Composition, Polymer Processing

**Week 7:** Phase Structure and Morphology of Bulk Polymers: Amorphous and Crystalline States, Viscoelasticity, Multicomponent Polymer Systems, Properties of Bulk Polymers.

**Week 8:** Properties of Bulk Polymers (Cont.): Mechanical, Optical, Electrical, Surface and Other Industrially Relevant Properties, Polymer Degradation and Stability, Polymer Additives, Few Contemporary Topics, Challenges and Opportunities in Polymer Science.