FIRST SEMESTER 2015-16
Course Handout (Part II)

Date:03/08/2015

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No	**:**	**CHE G522**
Course Title	**:**	**Polymer Technology**
Instructor-in-Charge	**:**	**Banasri Roy**

1. Course Description:

Classification of polymers; Polymerization techniques; mechanism and kinetics of formation of polymers; different techniques for determination of different types of molecular weights; polymer structure; definition and measurement of glass transition and crystalline melting temperatures; polymer properties; viscoelasticity and rubber elasticity behavior; degradation and stability; polymer processing; rheology and applications.

2. Scope & Objective:

Polymers have become an essential part of everyday life and are used extensively in a wide range of applications, from medical appliances, sporting and electrical goods to automotive, construction etc. Polymer engineers need to apply the traditional skills of chemical engineers, such as plant design, process design, thermodynamics, and transport phenomena, to various problems involving the production and use of polymers. More than half the chemical engineers in the world are working with polymers in one form or another.

This course is designed to learn the fundamentals of polymer technology from the basics of polymer chemistry, structure, synthesis, and processing to more advanced topics, including structure-property relationships and end-use polymer design, solution thermodynamics, polymer mechanical properties, applications of polymeric materials, and how to choose the appropriate polymer for a particular application and polymer rheology and processing, where transport phenomena enter into the polymer technology. This course also gives an exposure to the students in the field of advancement of the course through projects related to recent research topics.

3. Text Book:

Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India, Pvt. Ltd., New Delhi, 2nd ed., ISBN: 978-81-203-2770-2.

4. Reference Books:

R1. Fred W. Billmeyer, Jr, "Textbook of Polymer Science", John Wiley & Sons, New York, 3rd ed., 1994. ISBN:978-812-6511105.

R2. Alfred Rudin, "The Elements of Polymer Science & Engineering", Academic Press, USA, 2nd ed., 1999. ISBN:0-12-601685-2.

5. Course Plan:

Lec. No.	Learning Objectives	Topics to be covered	Ref. Ch. /Sec. (Book)
1-2	Introduction to Polymer Science	Classification Of Polymers, Polymer Structure, Molecular Weight: Molecular Weight Averages, Molecular Weight Distribution	1 (TB) 2 (R2)
3-6	Synthesis of High Polymers	Step Growth Polymerization. Chain Growth Polymerization	2.1, 2.2 (TB)
7-8	Polymerization Techniques	Polymerization Techniques: Bulk polymerization, Solution Polymerization, Suspension Polymerization & Emulsion Polymerization. Reactions of Synthetic Polymers. Special Topics.	2.3-2.5 (TB)
9-10	Chemical Structure Determination	Vibrational Spectroscopy. NMR	2.6 (TB)
11-12	Molecular Weight Determination	Membrane Osmometry, Vapor Pressure Osmometry, Light Scattering Method, Intrinsic-Viscosity Measurements, Gel-Permeation Chromatography.	3. 3 (TB)
13-16	Solution Properties, Thermodynamics	Conformation Thermodynamics of Polymer Solutions	3.1, 3.2 (TB)
17-18	Solid-State Properties of Polymers	Amorphous State, Chain Entanglements & Reptation, Glass Transition, Crystalline State, Crystalline Melting Temperature, Crystallization Kinetics, Techniques to Determine Crystallinity	4.1, 4.2 (TB) 11 (R2)
19-20	Thermal transition & properties	Fundamental Thermodynamic Relationship, Thermal Transition in Polymeric Material, Determination of T_g By Dilatometry and Calorimetry.	4.3, (TB)
21-25	Mechanical Properties	Test to Determine Mechanical Performance in Polymers Static Test: Tensile, Shear Transient Test: Creep Test, Stress Relaxation, Impact & Cyclic Test	4 (TB)
26-28	Viscoelasticity	Introduction to Viscoelasticity, Dynamic-Mechanical Analysis, Mechanical Models of Viscoelastic Behavior	5 (TB)
29	Polymer Processing	Extrusion, Molding, Spinning Calendaring, Coating.	11.1(TB)
30-33	Polymer Rheology	Introduction to Polymer Rheology, Analysis of Simple Flows, Rheometry.	11.2-11.4(TB)
34	Polymer degradation, stability and environmental issues	Thermal Degradation Oxidative & UV-Stability, Management Of Plastics In Environment.	6 (TB)
35	Polymer additives	Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants	7 (TB), 17 (R1)
36-37	Polymer in use	Biopolymers; Fibers	8 (TB)
38-41	Polymers for advanced Technology	Membrane Science and Technology; Biomedical Engineering; Electronic Applications	12 (TB)

6. Evaluation Scheme:

Component	Duration	Date	Weightage (300 marks/100%)	Remarks
Class Assessments	---		30 (10%)	Attendances/Group problems/Quiz
Mid-Term Test	1½ hrs	5/10 10:00 - 11:30 AM	75(25%)	CB and/or OB
Project	--		60 (20%)	--
Assignments	--		30 (10%)	--
Comprehensive	3 hrs	1/12 AN	105 (35%)	CB and/or OB

CB - Close book OB - Open book

- 15 marks (3%) extra for class participation, and attendance
- Course plan may not follow the exact sequence. It will be discussed in class.
- Chamber consultation hour will be announced in the class.
- The notices will be displayed on the Nalanda only.
- Make-up will be granted for genuine cases only. Certificate from authenticated doctor from the Medical Center must accompany make-up application (*only prescription or vouchers for medicines will not be sufficient*). Prior permission of IC is compulsory.
- No make up for tutorial tests.

Instructor-in-charge
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