SECOND SEMESTER 2015-2016
Course Handout (Part II)

Date: 05/01/2016

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding this course.

Course No. : **CHEM F325**
Course Title : **POLYMER CHEMISTRY**
Instructor-in-charge : **SUBIT KUMAR SAHA**

1. **Objective of the course:** The objective of the present course is to introduce the foundation of the subject by studying types and structures of polymers, molecular weight of polymers, kinetics of polymerization, thermodynamics of polymer solutions, thermal and mechanical properties of solid polymers, polymer's viscoelasticity and rubber elasticity, commodity, network, engineering and specialty polymers and applications for polymers in separations, biotechnology and electronics.
2. **Text Book (TB):** Fried, Joel R., Polymer Science and Technology, 2nd Edition, Prentice-Hall of India Pvt. Ltd. New Delhi, 2005.
3. **Reference Books (RB):** Bahadur, P. and Sastry, N.V., Principles of polymer Science, Narosa Publishing House, New Delhi, 2002.
4. **Course Plan:**

Contents	Learning objectives	Topic	No. of Lectures	Chap./ Sec. No.
Introduction to polymer science	Classification of polymers, structure of polymers, molecular weights and chemical structure and thermal transitions.	(i) Classification of polymers	1	TB 1.1, RB 1.2
		(ii) Polymer structure and isomerism	2	TB 1.2, RB 1.4
		(iii) Molecular weight and chemical structure and thermal transitions	2	TB 1.3 & 1.4, RB 3.3.1
Synthesis of polymers	Synthesis and kinetics of different types of polymerization	(i) Step-growth polymerization	1	TB 2.1, RB 2.2
		(ii) Chain-growth polymerization	2	TB 2.2, RB 2.1

Contents	Learning objectives	Topic	No. of Lectures	Chap./ Sec. No.
Polymerization techniques and reactions of synthetic polymers	The different techniques of polymerization and the reactions of synthetic polymers	Polymerization techniques, reactions of synthetic polymers and special topic in polymer synthesis	1	TB 2.3-2.5
Polymer conformations and chain dimensions	Different model to explain confirmations and chain dimensions	Polymer conformation and chain dimension	1	TB 3.1
Thermodynamics of polymers solutions	How thermodynamics of polymers solutions differs from the thermodynamics of ordinary solutions	(i) Flory-Huggins theory and Flory-Krigbaum and modified Flory-Huggins theory	1	TB 3.2.1 & 3.2.2, RB 4.3
		(ii) phase equilibria	1	TB 3.2.4
		(iii) Determination of interaction parameter and prediction of solubilities	1	TB 3.2.5 & 3.2.6 RB 4.3
Determination of molecular weight	The principles behind both primary and secondary methods for molecular-weight determination	(i) Osmometry	1	TB 3.3.1, RB 3.3.3
		(ii) Light-Scattering method	1	TB 3.3.2, RB 3.3.3
		(iii) Intrinsic-Viscosity measurement	1	TB 3.3.3 RB 3.3.3
		(iv) Gel-Permeation Chromatography	1	TB 3.3.4
The solid state properties of polymers	Thermal and mechanical properties of different solid states of polymers	(i) Amorphous state	1	TB 4.1.1-4.1.3
		(ii) Crystalline state	1	TB 4.2.1 - 4.2.4
		(iii) Thermal transitions and properties	1	TB 4.3.1 & 4.3.2
		(iv) Structure property relationships, effect of molecular weight, composition and pressure on T_g	1	TB 4.3.3 & 4.3.4
		(v) Mechanical properties	2	TB 4.4

Contents	Learning objectives	Topic	No. of Lectures	Chap./ Sec. No.
Viscoelasticity and rubber elasticity	Introduction to viscoelasticity and rubber elasticity	(i) Introduction to viscoelasticity	1	TB 5.1.1, RB 4.4
		(ii) Introduction to rubber elasticity	1	TB 5.2
Polymer degradation and the environment	Effects of environmental agents on polymers	Polymer degradation, stability and management	1	TB 6.1 & 6.2
Polymer additives, blends and composites	Effect of additives, blends and composites on the properties of polymers	(i) Additives	1	TB 7.1.1 & 7.1.2
		(ii) Other important additives and polymer blends	1	TB 7.1.3 & 7.2.1
		(iii) Polymer composites	1	TB 7.3.1
Biopolymers and Natural polymers	Polymers in biological systems and nature	Biopolymers and other naturally occurring polymers	1	TB 8.1
Commodity thermoplastics and fibers	To know different types of thermoplastics and fibers and their properties	(i) Fibers	1	TB 8.2.1 – 8.2.3 RB 5.3
		(ii) Thermoplastics	1	TB 9.1 RB 5.2
Network polymers	To know different types of network polymers and their properties	(i) Elastomers	1	TB 9.2, RB 5.4
		(ii) Thermosets	1	TB 9.3
Engineering and specialty polymers	Introduction to some outstanding polymers and their properties and comparison with commodity thermoplastics	(i) Engineering thermoplastics	1	TB 10.1
		(ii) Specialty polymers	1	TB 10.2, RB Ch. 8
Applications of polymers	Applications for polymers in separations, biotechnology and electronics	(i) Membrane separations & preparation	1	TB 12.1.2
		(ii) Biomedical applications, applications in electronics and photonic polymers	2	TB 12.2-12.4
Synthesis	Hands-on synthesis of some polymers		2	

5. Evaluation Scheme [*1]:

Component	Duration	Weightage (%)	Date & Time
Mid-Sem Test	90 Minutes	30	16/3 2:00 -3:30 PM
Quiz/Assignment/ Seminar[*2]		30	Continuous
Comprehensive Exam[*3]	3 hours	40	9/5 FN

- [*1]Regular attendance in the class will be considered as a plus during the final evaluation.
- [*2]Quiz/Assignment will be conducted in some of the lecture classes. Separate arrangements will be made for conducting seminars.

- [*3]A part of the comprehensive examination will contain open book questions.

6. Consultation Hour: To be announced in the class
7. Notice: Notices concerning this course will be displayed on the Chemistry Deptt. Notice Board.
8. Make-up Policy: Refer to Part-I of the handout for details.

Instructor-in-charge, CHEM F325