

CY641 Polymer Synthesis

Credits: 3-0-0-3

Approval: Approved in 2nd Senate

Prerequisite: Consent of the faculty member

Students Intended for: B.Tech/MS/PhD

Elective or Core: Elective

Semester: Odd/Even

Course outline

The course is divided into weekly topics or modules. This is a tentative outline and an update will be provided each week in class.

- **Week1:** INTRODUCTION: Definition, types of polymers, polymer mechanisms, polymer properties
- **Week 2:** STEP GROWTH POLYMERIZATION: General Theory. Types of step growth polymerization reactions. Gelation
- **Weeks 3 & 4:** CARBONYL ADDITION-ELIMINATION REACTIONS: Polyesters, polyamides, polyimides etc.
- **Week 5:** NUCLEOPHILIC SUBSTITUTION REACTIONS: Epoxy resins. MULTIPLE BOND ADDITION REACTIONS: Polyurethanes, Diels Alder reactions.
- **Week 6 :** Midterm exam
- **Week 7:** FREE RADICAL POLYMERIZATION: Chemistry of free radicals. Initiation, propagation, termination mechanisms and kinetics, MWD, Free radical coupling reactions, Living free radical polymerizations
- **Week 8:** Class oral presentations I
- **Week 9:** IONIC POLYMERIZATION: Cationic and anionic.
- **Week 10 :** Ionic polymerization contd. Addition polymerization by radiation. Group transfer polymerization.
- **Week 11:** COPOLYMERS: Free radical copolymerization, Block copolymers, Telechelic polymers, IPN/SIPN, Ring Opening Polymerization
- **Week 12:** Oral class presentations.
- **Week 13:** COORDINATION POLYMERIZATION: Ziegler-Natta catalysts; stereo regular polymers; olefin metathesis; metallocene catalysts. Polyacetylenes.
- **Week 14 & 15:** If time permits we can cover additional topics of general interest, e.g. biomaterials, nanomaterials etc.
- **Week 16, May 21st:** Final exam

GRADE

Midterm exam (Take home) 25%

Final exam (Take home) 25%

Written/oral presentation I* 25%

Written/oral presentation II* 25%

TOTAL 100

*Written/oral presentations can be either "traditional" term papers based on relevant contemporary scientific literature, or a "research proposal" based on the development of a hypothesis. In either case you should discuss with me the topics to establish their relevance for this course.

Required texts:

1. Principles of Polymerization, Fourth Ed, George Odian, Wiley, 2004
2. Polymer Chemistry An Introduction Third Edition, Malcolm P. Stevens, Oxford, 2011

Journals

Macromolecules

Biomacromolecules

J. Am. Chem. Soc.

MacroLetters

NanoLetters

Chemistry of Materials