هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Polymer Chemistry**
Course Code:	**2044202-2**
Program:	**Bachelor in Chemistry**
Department:	**Department of Chemistry**
College:	**College of Sciences**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours:	**2 (Theoretical)**
2. Course type	
a.	University ☐ College ☐ Department √ Others ☐
b.	Required √ Elective ☐
3. Level/year at which this course is offered:	**8th Level/ 4th Year**
4. Pre-requisites for this course (if any)**:**	**Organic Chemistry 2 (2042203-3)**
5. Co-requisites for this course (if any)**:**	**NA**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	2 Theoretical hours/ Week	100 %
2	**Blended**	-	-
3	**E-learning**	-	-
4	**Distance learning**	-	-
5	**Other**	-	-

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**30**

B. Course Objectives and Learning Outcomes

1. Course Description

The course includes detailed explanation of polymer definition, the general physical and chemical properties of polymers, their characterization and molecular weight determination. It also describes the different polymerization techniques and industrial methods and instrumentation.

2. Course Main Objective

This course is designed to give an extensive knowledge of polymer science, this include polymerization methods, physical properties of polymers and various industrial applications.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	Recognize different polymeric materials commonly seen in our environment and their industrial applications	K1
1.2	Determine the relationship and interactions between chemistry and industrial applications	K2
2	**Skills:**	
2.1	Differentiate between polymers depending on their physical and	S1

CLOs		Aligned-PLOs
	chemical properties	
2.2	Evaluate the environmental impact of polymers	S3
3	**Values:**	
3.1	Participate in the development of the performance of work teams	V1

C. Course Content

No	List of Topics	Contact Hours
1	**Section1: Introduction, definition, general properties of polymers** Definition of monomers, oligomers and Polymers. Polymerization techniques and structure of some important polymers. Nomenclature of Polymers. Configuration of polymers chains (structure and microstructure)	4
2	**Section 2: Characterization and determination of Molecular weight of polymers** Number and weight average molecular weight (Mn and Mw). Polydispersity index (PDI). Degree of Polymerization. Experimental determination of molecular weight. Gel permeation chromatography (GPC). Measurement of solution viscosity.	2
3	**Section 3: Physical properties of polymers** Polymer solution. Polymers in solid state. Degree of crystallinity (Dc). .Glass transition temperature (Tg). Effect of polymer structure on Tg. Fox equation. Mechanical properties of polymers.	2
4	**Section 4: Step Polymerization** Kinetic of step polymerization. Carothers equation. Factors influencing. Molecular weight of polymers resulted of step polymerization.	4
5	**Section 5: Chain polymerization** General characteristics. Common classes of chemical initiators. Initiator efficiency. Kinetic of free radical polymerization. Chain transfer reactions. Inhibition and Retardation. Polymer Tacticity.	4
6	**Section 6: Anionic Polymerization** Anionic initiators. Mechanism and reactivity in anionic polymerization. Calculating molecular weight and degree of polymerization for polymers resulted of anionic polymerization. Stereochemistry of anionic polymerization of diene.	4
7	**Section 7: Cationic and ring opening polymerization** Cationic initiators. Mechanism and reactivity in cationic polymerization. Ring-Opening Polymerization of N-Carboxyanhydrides (NCA). Ring-opening polymerization with Ziegler-Natta catalysts. Production of polyacetylene by using Ziegler-Natta catalysts.	4
8	**Section 8: Physical forms of polymerization** Bulk polymerization. Solution polymerization. Precipitation of polymerization. Dispersion of polymerization. Suspension of polymerization. Emulsion of polymerization.	2
9	**Section 9: Living radical polymerization (Part I)** Nitroxide-Mediated Living Radical Polymerization. Atom Transfer Radical Polymerization (ATRP). ATRP formulation. Polymerization of styrene by ATRP.	2
10	**Section 9: Living radical polymerization (Part II)**	2

	Reversible Addition Fragmentation Chain Transfer (RAFT). Chain Transfer Agents: Possible Structures	
Total		**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Recognize different polymeric materials commonly seen in our environment and their applications	Lecture	Written exam
1.2	Determine the relationship and interactions between chemistry and industrial applications.	Lecture	Written exam
2.0	**Skills**		
2.1	Differentiate between polymers depending on their physical and chemical properties.	Discussion	Homework Assignments
2.2	Evaluate the environmental impact of polymers	Discussion	Homework Assignments
3.0	**Values**		
3.1	Participate in the development of the performance of work teams.	Collaborative Learning	Individual presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework Assignments (Electronic)	Throughout Semester	15%
2	Individual presentations	Throughout Semester	5%
3	Periodical Exam	7/8	15%
4	Mid Term Exam	11/12	15%
5	Final exam	16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Commitment to the rules of the Academic Advising Department at the university in accordance with the academic guidance manual approved by the university and the attached forms, there are different arrangements made by teaching staff to support student consultations including;
- Office hours: 8 hours per a week for each academic member.
- Academic guidance: an academic member has a number of students to guide them throughout degree journey.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• Principles of Polymerization. Odian, George G., 2004, Latest Edition. New York (USA). ISBN: 9780471274001.
Essential References Materials	• Introduction to Physical Polymer Science. L. H. Sperling, 2005, Latest Edition. New York (USA). ISBN: 9780471706069.
Electronic Materials	• Saudi Digital Library (SDL)
Other Learning Materials	• Learning Management System (Blackboard) • Computer programs for graphing organic compounds and chemical reactions (Chem draw , Chem sketch)

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Lecture hall with 100 seats.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Computer and data show with Wi-Fi access. • ChemDraw and Chem sketch software.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	--

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and assessment	Students	Survey (indirect method)
Extent of achievement of course learning outcomes	Program leader	Reports (Direct method)
Quality of learning resources	Peer referees Students	Reports (Direct method) Survey (indirect method)

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department Council/ Quality assurance committee**
Reference No.	7-3-1445
Date	27/2/1445 HJ 12/09/2023 G