مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	**Polymer Chemistry**	
2	**Course number**	**0303452**	
3	**Credit hours**	**3**	
	Contact hours (theory, practical)	**3**	
4	**Prerequisites/corequisites**	**0303232 (Organic Chemistry 2)**	
5	**Program title**	**B.Sc. Degree in Chemistry**	
6	**Program code**	**02**	
7	**Awarding institution**	**The University of Jordan**	
8	**School**	**Sciences**	
9	**Department**	**Chemistry**	
10	**Course Level**	**Bachelor**	
11	**Year of study and semester (s)**	**2021-2022 / Summer Semester**	
12	**Other department (s) involved in teaching the course**	**none**	
13	**Main teaching language**	**English**	
14	**Delivery method**	Face to face learning Blended ☒Fully online	
15	**Online platforms(s)**	☒Moodle ☐Microsoft ☒ Teams ☐Skype ☒Zoom ☐Others……	
16	**Issuing/Revision Date**		

17 Course Coordinator:

Name: **Dr. Abdussalam K. Qaroush**

Monday-Thursday: 15:00-16.00

Or by appointment Office number: 38 Phone number: **22179**

Email: **a.qaroush@ju.edu.jo**

18 Other instructors:

N/A

19 Course Description:

This course deals with nomenclature and types of polymers, the shapes and sizes of polymer molecules, molecular weight determination, polymer properties in solution and in the solid state. In addition, polymerization mechanisms and controlling end groups. Well-known examples will illustrate selected applications. Together with more focus on the use of green chemistry as well as sustainable development goals when dealing with current industries to help mitigate the climate change global disruptions.

20 Course aims and learning outcomes (CLOs):

A- Aims

This course is intended to give students an overview of the Polymer Chemistry course topics. At the course completion, students will understand the fundamentals of the polymer chemistry and they will be able to evaluate different techniques in certain applications.

B- Course Learning Outcomes: Polymer Chemistry (0303452)

Upon successful completion of this course, students will be able to:

CLO-1: **A.** Summarize historical evolution of polymers.
CLO-2: **B.** Categorize polymers and manage to assign different methods for molecular weight determination.
CLO-3: **C.** Use essential descriptions about polymer chemistry including structures and stereochemistry.
CLO-4: **D.** Solve the problems about polymer chemistry (thermal and physical, and chemical properties).
CLO-5: **E.** Categorize polymerization reactions & mechanisms and distinguishes differences among them.
CLO-6: **F.** Explain polymer production processes.

B- Students Learning Outcomes (SLOs):

SO-1. Problem Solving: Graduates will be able to apply mathematical and scientific knowledge to identify, formulate, and solve technical or scientific problems relevant to the discipline of chemistry.
SO-2. Design: Graduates will be able to use their understanding of chemistry concepts and principles to formulate and design systems, processes, procedures, or programs to meet desired goals and outcomes.
SO-3. Experimental Skills: Graduates will be able to design, conduct, and analyze experiments or test hypotheses, utilizing appropriate chemical techniques and scientific judgment to draw meaningful conclusions.
SO-4. Communication: Graduates will be able to communicate scientific information effectively and accurately to a range of audiences, including both technical and non-technical audiences.
SO-5. Ethics and Global Context: Graduates will understand and apply ethical and professional responsibilities in the context of the impact of technical and scientific solutions on global, economic, environmental, and societal issues.
SO-6. Teamwork: Graduates will be able to work effectively as part of a team, establishing goals, planning tasks, meeting deadlines, and analyzing risk and uncertainty in the context of chemistry-related projects and initiatives.

Handling Chemicals: An ability to apply the proper procedures for safe handling of chemicals

		Student Outcomes (SO)						
		SO-1	SO-2	SO-3	SO-4	SO-5	SO-6	SO-7
Course Learning Outcomes (CLO)	CLO-1	✓				✓	✓	
	CLO-2	✓				✓	✓	
	CLO-3	✓				✓	✓	
	CLO-4	✓				✓	✓	
	CLO-5	✓				✓	✓	
	CLO-6	✓				✓	✓	

21. Topic Outline and Schedule:

1.

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
I. Basic Principles Definitions, classification of polymers, polymerization reactions nomenclature	**1**	**AKQ**	**A+B+C+D**	Written Evaluation	Text Book(s) Web Resources
II. Polymer Structure and Polymer Morphology Polymer morphology, interchain interactions, glass transition temperature, stereochemistry, polymer crystals, amorphous state, chemical and physical crosslinking	**2**		**A+B+C+D**	Written Evaluation	Main Text Book Web Resources
III. Polymer Characterization - Molar Masses Definition of molar mass averages, polymer solutions, the measurement of absolute molar masses, secondary methods of	**2**		**A+B**	Written Evaluation	Main Text Book Web Resources

molar mass determinations, molar mass distribution						
IV. Chain Reaction Polymerization Addition reaction, free radical polymerization, monomers for radical polymerization, general chain addition reaction, initiators, chain reaction sequence, mechanism, steady state kinetics, chain transfer, commercial polymers, polymerization of dienes, copolymerization, polymerization techniques	**2**		**D+E+F**	Written Evaluation	Main Text Book Web Resources	
V. Ionic and Coordination Polymerization Cationic polymerization, initiators, kinetics, anionic polymerization, initiators, kinetics, ionic copolymerization, coordination polymerization	**4**		**D+E+F**	Written Evaluation	Main Text Book Web Resources	Main Text Boo **Web Resourc**
VI. Copolymerization General characteristics, composition drift, copolymer equation, monomer reactivity, reactivity ratios and copolymer structure, structural effects & monomer reactivity ratios, classification of copolymers	**4**		**D+E+F**	Written Evaluation	Main Text Book Web Resources	
VII. Green chemistry Why Green? Definition, Adaptation, development, application, sustainable development goals (SDGs) and green polymerization Methods	**5**		**A+B+C+D+E+F**	Written Evaluation	Main Text Book References	
VIII. Presentations	**6-7**	Students	**A+B+C+D+E+F**	Written Evaluation	Main Text Book References	
Final Exams	**8**	AKYQ	**A+B+C+D+E+F**	Written Evaluation	Main Text Book References	

2.

22 Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
quizzes	20%	**Topics (I-III)**	**CLO-1 CLO-2 CLO-3 CLO-4**	Three weeks	E-learning, MS Teams, Zoom and UJ Campus
Mid exam	30%	**Topics (IV-VII)**	**CLO-1 CLO-2 CLO-3 CLO-4 CLO-5 CLO-6**	Three weeks	UJ Campus
Final exam	50%	**Topics (I-VIII)**	**CLO-1 CLO-2 CLO-3 CLO-4 CLO-5 CLO-6**	Seven weeks	UJ Campus

A bonus of up to 2 marks will be given to innovative and brilliant active participation. May change depending on the submitted works (if properly submitted in front of the class).

Tentative Grading Scale:

A Mean Scale score based grading will be followed in class but not fixed scales following a normal distribution

23 Course Requirements

(e.g., students should have a computer, internet connection, webcam, account on a specific software/platform… etc.): Students should have a laptop internet connection.

24 Course Policies:

Discipline and Active Participation Policy (If applicable as a bonus, could be banned if it is insufficient):

All together discipline and active participation will be rewarded. **Attending the class by itself without any active participation does not permit having the 5% marks.**

- Participation frequency and relative grading percentage:
- Frequent is subject to 5% (good questions, valuable observations, and effective answers)
- Frequent semi-effective is subject to 3% (ineffective questions, observations, and answers)
- Infrequent is subject to 2% (ineffective and show low level of preparation)
- Rare is subject to 1%.

- Displaying no sign of life or long periods of absence is subject to 0%

VERY IMPORTANT RULES AND REGULATIONS:

- **Late assignments/Hws delivery <u>will</u> result in losing one grade per day for each assignment/ homework (HW), and a ZERO grade if repeated.**
- **<u>Plagiarism, forgery, or fabrication of data</u>** is considered an unethical activity. It may result in having a penalty, refer to **www.plagiarism.org** as well as **students code of conduct**.
- **A**ttendance and participation are mandatory, absence (unexcused that can surpass 15% of the total lecture attendance) may result in receiving an **ABSENT FAIL** grade or an equivalent **failure** (F) grade.
- **S**tructured participation to avoid interruptions/random ones.
- **C**heating is not tolerated in class, with no exceptions, it will result in having a penalty according to regulation followed by the University of Jordan (UJ).
- **U**pdate yourself in reading the most recent (up to date) UJ regulations regarding course attendance and grading.

<u>Notes:</u>

- Concerns or complaints should be expressed to the course instructor lecturer; if no not resolved, the student is asked to communicate with the head of department (HoD) or higher hierarchical entities within School.

25 References:

A- Required book(s), assigned reading and audio-visuals:

- **George Odian. (2004). Principles of Polymerization, 4th Edition. Wiley Interscience.**

A- Recommended books, materials, and media:

- **Khan Academy**, **Coursera**, **Edx**, and **YouTube** and optional video-aided portals that deals with polymer chemistry content.
- **Electronic Handouts**.
- R. B. Seymour and C. E. Carraher, Polymer chemistry-An Introduction, 3rd edition Marcel Dekker 1992.
- J. M. G. Cowie, Polymers: Chemistry and Physics of Modern materials, 2nd edition Blackie 1991.
- M. P. Stevens, Polymer Chemistry-An Introduction 2nd edition, Oxford Univ. Press, 1990.
- Ger Challa, Polymer Chemistry-An Introduction 3rd edition, Ellis Horwood, 1993.
- W. Billmeyer, Jr., Textbook of Polymer Science, 3rd edition, John Wiley, 1984.
- Young and Lovell, Introduction to Polymers, 2nd edition, Cambridge, Chapman & Hall, 1991.

Green Chemistry Textbooks

- P. T. Anastas, J. C. Warner, "**Green Chemistry: Theory and Practice**", 1998, Oxford University Press.
- Editor(s): Prof. Dr. Robert T. Mathers, Prof. Dr. Michael A. R. Meier. **Green Polymerization Methods**: Renewable Starting Materials, Catalysis and Waste Reduction, 2011, Wiley.

WebSites:

- www.knowledge-integrity.com
  See the list on the **UJ e-learning** website or much better to communicate via **MS Teams**

26 Additional information:

N/A

Name of Course Coordinator: ----------Signature: ---------- Date: ----------
Head of Curriculum Committee/Department: ---------- Signature: ----------
Head of Department: ---------- Signature: ----------
Head of Curriculum Committee/Faculty: ---------- Signature: ----------
Dean: ---------- Signature: ----------