

Kingdom of Saudi Arabia
The National Commission for
Academic Accreditation & Assessment



COURSE SPECIFICATION

(Introduction to Polymer Science, 402388-3)

1435 / 1436 H

Course Specification

Institution: Umm Al-Qura University
College/Department: Applied Science /Chemistry Department

A. Course Identification and General Information

1. Course title and code: Introduction to Polymer Science, 402388-3
2. Credit hours: 3 hrs (2 theoretical + 1 practical)
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Industrial Chemistry
4. Name of faculty member responsible for the course: Dr. Sayed Zaki Mohammady
5. Level/year at which this course is offered: 6th level/ Third year
6. Pre-requisites for this course (if any): Petroleum Chemistry 402380-3
7. Co-requisites for this course (if any): ———
8. Location if not on main campus: ———

B. Objectives

B Objectives

1. Summary of the main learning outcomes for students enrolled in the course. The aim of this course is to study the preparation of polymers and their physical properties and applications, and its economic importance, especially in Saudi Arabia.
2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field) - Encourage students to use the Internet in order to increase awareness of the concepts of polymer chemistry. - Regular update to the course material according to the recent references. - Using teaching smart lecture halls.

C. Course Description: (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1. Topics to be covered		
Topic	No of Weeks	Contact hours
Definition and structural composition of polymers.	1	2
Classification of polymers: according to their chemical composition, natural properties, and architectural form.	1	2
General methods for the preparation of polymers: (chain growth polymerization) free radical polymerization – mechanism of polymerization - kinetics of polymerization - the average length of polymerization – cationic and anionic polymerization.	2	4
Step growth polymerization: condensation polymerization (linear polymers and branched polymers – uses of synthetic fibbers).	1	2
Technical methods used in the production of polymers: pure polymerization- polymerization in solution - emulsion polymerization - polymerization in suspension.	2	2
Molecular weight of polymers: average molecular weight – determination of the weight average and number molecule weight- properties of dilute and concentrated solutions.	1	2
Phase transitions in polymers: the glass transition temperature - the movement of molecules in polymers - determination of glass transition - factors affecting the glass transition - dynamic thermal melting.	2	4
Crystallization in polymers: requirements for the crystal - the theory of folded molecules - the theory of folded chains - effect of crystallization on the properties of polymers.	1	2
Mechanical properties of polymers: the stress and strain curves – rubber elasticity - thermodynamics of the rubber elasticity - types of elasticity.	2	4

Examples of industrial applications of polymers and their economic importance, especially in Saudi Arabia.	1	2
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2. Course components (total contact hours per semester):			
Lecture: 28 h	Tutorial:	Practical/Fieldwork/Internship:	Other:

3. Additional private study/learning hours expected for students per week. (This should be an average: for the semester not a specific requirement in each week)
- Two office hours per week.

<p>4. Development of Learning Outcomes in Domains of Learning</p> <p>For each of the domains of learning shown below indicate:</p> <ul style="list-style-type: none"> • A brief summary of the knowledge or skill the course is intended to develop; • A description of the teaching strategies to be used in the course to develop that knowledge or skill. • The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.
<p>a. Knowledge</p> <p>(i) Description of the knowledge to be acquired.</p> <p>On completing this course students will be able to:</p> <ul style="list-style-type: none"> • Investigate the difference between the different methods of M.wt. determination • Calculate M.wt. from experimental data • Understand the nature and significance of glass transition in polymers • Investigate the factors affecting the T_g in amorphous polymers • Tolerate structure and properties • Understand the concept of crystallinity in polymers • Understand orientation in crystalline and amorphous products • Know how to measure crystallinity

- Investigate the factors controlling crystallinity in polymers
- Understand viscous and elastic elements of a polymer
- Investigate the difference between the stress-strain and viscoelastic behavior of rubbers and plastics.
- Recognize the environmental and industrial issues related to polymers.

(ii) Teaching strategies to be used to develop that knowledge

- Scientific discussions and work in small groups.
- The use of the Internet in the work of some public reports of methods for preparation of polymers and their uses and its future role.

(iii) Methods of assessment of knowledge acquired

- The final written examinations and the middle of the semester.

b. Cognitive Skills

(i) Cognitive skills to be developed

After finishing this course the student will have the ability to:

- Select the appropriate methods for the preparation of polymers.
- Design different ways to prepare polymers
- Creates different ideas for the construction of many of the polymers
- Plan to do a research program in the field of polymer chemistry according to the steps
- Choose the appropriate mechanical interaction of the chemicals for the preparation of polymers.
- Determine the technical and manufacturing of polymers and their uses according to the thermal transformation of the polymers.

(ii) Teaching strategies to be used to develop these cognitive skills

- To generate discussion in the classroom.
- Examples are given in the lecture and exercises in the workshops.
- Give some of the issues and ask the students applied to finding a strategic plan to resolve.
- Encourage the transfer of learning using the tools of analysis in different applications and through discussion of potential applications in other areas.
- Students assigned duties that include the functions of open tasks designed for the application of skills forecasting and analysis and problem solving.

<p>(iii) Methods of assessment of students cognitive skills</p> <ul style="list-style-type: none"> • Tests. • Measure the response of the assignments.
<p>c. Interpersonal Skills and Responsibility</p>
<p>(i) Description of the interpersonal skills and capacity to carry responsibility to be developed</p> <ul style="list-style-type: none"> • The ability to actively seek, identify and create effective contacts with others, and to maintain those contacts for mutual benefit. • In addition to strong Communication Skills and Personal Skills, Networking uses the Background skills of network building and motivating others.
<p>(ii) Teaching strategies to be used to develop these skills and abilities</p> <ul style="list-style-type: none"> • Involves working with others in a group towards a common goal. This requires cooperating with others, being responsive to others' ideas, taking a collaborative approach to learning, and taking a responsibility for developing and achieving group goals. • Teamwork uses the Background skills of collaboration, mentoring, decision making and delegation.
<p>(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility</p> <ul style="list-style-type: none"> • Evaluation of results and analysis of the experiences and knowledge of blending the contribution of each individual in the interpretation through dialogue and discussion.
<p>d. Communication, Information Technology and Numerical Skills</p>
<p>(i) Description of the skills to be developed in this domain.</p> <ul style="list-style-type: none"> • Use of computers in the compilation of research that will help in the writing of reports for topics relevant to the decision. • The use of computers and the Internet to identify the sources of recent research relevant to the decision.
<p>(ii) Teaching strategies to be used to develop these skills</p> <ul style="list-style-type: none"> • Using the computer lab. • Visit the Central Library • The use of international information network.
<p>(iii) Methods of assessment of students numerical and communication skills</p>

<ul style="list-style-type: none"> Put in the test questions explanation of some simple statistical information. Evaluation of the duties associated with the proper use of communication skills and numerical.
e. Psychomotor Skills (if applicable)
(i) Description of the psychomotor skills to be developed and the level of performance required <ul style="list-style-type: none"> Not applicable.
(ii) Teaching strategies to be used to develop these skills <ul style="list-style-type: none"> Not applicable.
(iii) Methods of assessment of students psychomotor skills <ul style="list-style-type: none"> Not applicable.

5. Schedule of Assessment Tasks for Students During the Semester:			
Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final Assessment
1	Class activities, Attendances and Duties	Throughout the Term	10%
2	Mid-Term Exam (s)	5-14	20%
3	Lab Activity and Final Exam on Lab	Throughout the Term	30%
4	Final Exam	End of the Term	40%
5	Total		100%

D. Student Support

<p>1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)</p> <ul style="list-style-type: none"> Presence of faculty members to provide counselling and advice. Office Hours: weekly during working hours, and to create appropriate means. Academic Advising for students to those who need it, and taking into account the appropriate test for that Member.
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E. Learning Resources

1. Required Text(s) <ul style="list-style-type: none">• Lecture notes prepared by the lecturer.
2. Essential References <ul style="list-style-type: none">• L. H. Sperling, Introduction to Physical Polymer Science, 4th Edition, Wiley, 2009.• I. M. Ward and J. Sweeney, An Introduction to The Mechanical Properties of Solid Polymers, 2nd Edition, Wiley, 2004. (TA455.P58 W36 2004).
3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List) <ul style="list-style-type: none">• Encyclopedia of polymer science and technology, 4th. ed., John Wiley and Sons, Inc, 2012.
4- Electronic Materials, Web Sites etc <ul style="list-style-type: none">• Encyclopedia of polymer science and technology.• http://en.wikipedia.org/wiki/Petroleum1 - http://www.chemhelper.com/• http://www.chemweb.com/• http://www.science.uwaterloo.ca/~cchieh/cact/• http://www.sciencedirect.com/
5- Other learning material such as computer-based programs/CD, professional standards/regulations <ul style="list-style-type: none">• Microsoft PowerPoint, Microsoft Word

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Lecture rooms, laboratories, etc.) <ul style="list-style-type: none">• Classroom capacity (60) students.• To supply the classrooms with the appropriate educational means.
2. Computing resources <ul style="list-style-type: none">• Hall is equipped with a computer and Data Show and TV.
3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list) <ul style="list-style-type: none">• None.

G. Course Evaluation and Improvement Processes

<p>1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching</p> <ul style="list-style-type: none">• Complete the questionnaire assessment due in particular. - Focus group discussions with small groups of students.
<p>2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department</p> <ul style="list-style-type: none">• Observations and assistance of colleagues.• Independent evaluation of the extent to which students of the standards.• Independent advice to the duties and tasks.
<p>3. Processes for Improvement of Teaching</p> <ul style="list-style-type: none">• Workshops to teaching methods.• Ongoing training of faculty member.• Review the proposed strategies.• Providing modern tools necessary for learning.• Application of the means of e-learning.• The exchange of internal and external expertise.
<p>4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)</p> <ul style="list-style-type: none">• Examination of a sample of the patch test papers, or student work, which has been corrected by a faculty member.• Exchange a sample of assignments or tests on a regular basis between faculty members of the same course in other educational institution.
<p>5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.</p> <ul style="list-style-type: none">• Consult the other professors of the course.• Host a visiting professor to evaluate the course.• Workshops for professors of the course.• Periodic review of the contents of the course and amend the negatives.