هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Physical Chemistry of Polymers
Course Code:	**CHEM330**
Program:	**Baccalaureate**
Department:	**Chemistry department**
College:	**Science**
Institution:	**King Saud University**

Table of Contents

A. Course Identification

1. Credit hours: (1 + 1)
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: *Junior level 3th year*
4. Pre-requisites for this course (if any)**:**
5. Co-requisites for this course (if any)**:**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	3	10
2	**Blended**	9	30
3	**E-learning**	9	30
4	**Distance learning**	9	30
5	**Other**	-	-

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	20
2	**Laboratory/Studio**	20
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

The program of the CHEM330 module covers a brief description of the methods of synthesis of polymers and copolymers as well as the different methods used in the determination of molecular masses. It also includes a detailed study on the thermal properties of polymers such as glass transition, fusion, crystallization and also the thermal stability.

2. Course Main Objective

- knowing the different structures-proprieties relationships of polymers
- Knowing the different methods used in the preparation of polymers and copolymers
- Learn how to characterize the physico-chemical properties of polymers

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	*Define and describe the different structures of polymers and copolymers*	

	CLOs	Aligned-PLOs
1.2	*Describe the thermal properties of polymers*	*Understand, resolution and application*
1.3	*Recognize and difference between the different molecular masses of polymer and define the physic-chemistry methods used do determine their values*	
2	**Skills :**	
	Cognitive Skills	
2.1	*Interpret the different structures of polymers and copolymers and evaluate the critical points.*	*Calculate, evaluate, interpret and Comment*
2.2	*Interprete the results of the preparation of polymers and copolymers(Thermograms (DSC and TGA)*	
2.2	*Calculate, experimentally determinate and analyze the different masses molecular of polymers such the average number molecular weigth, average weight molecular weight, average viscosimetric molecular weight and the polydispersity index.*	
2.3	*Estimate the changes in the glass transition temperature, melting point and crystallization temperature of polymers. Notion of crystalline and amorphous polymer.*	
2.6	*Represent and interpret the experimental data*	
	Interpersonal Skills & Responsibility	
2.7	*-Work independently and as in groups including leadership responsibilities;* *- Act responsibly in a personal manner;* *-Display of ethical and high moral standards in both private and public environments.*	*Master, Empower, educate*
2.8	*-Use sta- Manage resources, time and other members of the group* *- Communicate results of work to other*	
	Communication, Information Technology, Numerical	
2.9	*- Utilizing university electronic resources of learning.* *-Interpretation of numerical, chemical and general scientific information*	*Mastery of electronic means and communications*
	Psychomotor	
2.10	*Prepare polymers, manipulate the analytic instruments, draw the curves for determining different parameters such as average molecular weight of*	*Handle, analyze, criticize*

	CLOs	Aligned-PLOs
	polymers and critical points	

C. Course Content

No	List of Topics	Contact Hours
1.	**1. Generalities**	2
	1.1 Definition and Classification of Polymers 1.2 Natural polymers 1.3 Synthetic polymers	
	2. Determination of structure and microstructure	3
	2.1 Chemical structure and microstructure *2.1.1 Naming the polymers and copolymers* *2.1.1 Definition of the polymer structures* *2.1.2 Definition of the polymer microstructure (tacticity, cis, trans, etc)* 2.2 *Polymer crystalline and polymer amorphous*	
2	**3. Polymerization and copolymerization of monomers**	5
	3.1 Properties of polyaddition reaction *3.1.1 Free Radical Polymerization* *3.1.2 Controlled radical polymerization (CRP)* *3.1-3 Anionic polymerization* *3.1.4 Cationic polymerization* *3.1.5 Coordination polymerizations* 3.2 Properties of free radical copolymerization reaction *3.2.1 Alternative Copolymer* *3.2.2 Random copolymers* *3.2.3 Block copolymers* *3.2.4 Grafting copolymers*	
4	**4. Techniques used to Determine the average molecular weight**	5
	4.1 Notion of molecular mass in the polymers (statistical calculation) 4.2 Experimental methods used to determine the molecular mass of polymers 4.2.1 *Viscosimetry* *4.2-2 Osmometry* *4.2.3 Terminal group evaluation* *4.2.3 Size exclusion Chromatography* *4.2.4 Light scattering*	

	5. Thermal properties of polymers	5
	5.1 DSC technique and the transition, melting and crystallization principles 5.2 TGA technique and degradation, depolymerization and thermal stability notions	
Total		20

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	*-Define the different techniques used to prepare polymers and copolymers (polyaddition, polycondensation and ring opening polymerization) and compare the relationships between them*	*Use interactive method (question-answer),* *Incorporation of the IT to develop the knowledge and particularly (the smart board, internet),* *Proposing stimulation questions*	*Homework assignments,* *Using active learning techniques,* *-Major final and two segmented midterm exams*
1.2	*-Describe the thermal properties of polymers*		
…	*-Recognize and describe the transitions in the polymers (thermograms DSC and TGA)*		
2.0	**Skills**		
2.1	*Interpret the DSC and TGA thermograms and evaluate the different parameters (Tg, Tm, Tc, …)*	Manipulation in the lab *- Solving examples,* *- Class discussions,* *- Using modern methods of teaching such as the IT ways,*	*Lab. 2 Exams* *Following up students participations in class discussion activities.* *Major and final exams* *Problem solving by students on board*
2.2	*Define the structures of polymers and copolymers* .		
2.3	*Estimate the structure-property of polymers*		
2.4	*Estimate thermal properties of polymers.*		
2.5	*Represent and interpret the experimental data*		
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	*Resolution of problems*	*Give more exercises and problems to solve in group work.*	*MED: 1 and 2* *Final exam* *Quizzes + noted interactive questions*
3.2	*Exploitation of results*	*Provide tables from experimental data and let the student draw the curves and deduce the important parameters.*	*Labs exam*
3.3	Communication of results	*Make the links between the results obtained and the translators.*	*MED: 1 and 2* *Final exam* *Quizzes + noted interactive questions*

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	*Class activities (in-class quizzes, homework)*	*Weekly*	*10%*
2	*Major Exam I*	*Week 6*	*25%*
3	*Major Exam II*	*Week 12*	*25%*
4	*Revision*	*Week 13*	-
5	*Final Exam*	*Week 16*	*40%*

***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 :

Daily individual consultations of students which takes place according to a program drawn up by the teacher according to his availability.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Polymers 3rd Edition Robert J. Young and Peter A. Lovell
Essential References Materials	N.A.
Electronic Materials	N.A.
Other Learning Materials	*Software*: *Word, Excel, Power-Point presentations, Chemdraw, etc.*

5. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	*Laboratory (10 experimentations)*
Technology Resources (AV, data show, Smart Board, software, etc.)	*Using Smart board*
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	*N.A.*

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Faculty	*Administrators*	*Feed back*
Department	*Administrators*	*Feed back*
	Students	*Feed back*

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	Faculty
Reference No.	
Date	2023-01-25