Course Specification
(Bachelor)

Course Title :	**Catalysis and Surface chemistry**
Course Code:	**CHM 1346**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 2 (2, 0, 0)					
2 (2 Lect, 0 Tutorial, 0 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 6/ 3rd year					
4. Course general Description:					
This course describes the definitions and types of homogeneous and heterogeneous catalysts, extending to the preparation methods and characterization. This course designed to provide with the concepts of heterogeneous catalysis, theoretical, methodological and technical knowledge of the catalysts and catalytic cycle. The course will cover surface Chemistry: Solid surfaces and their characterization; Adsorption on solid surfaces: technique for measurement of adsorption.					
5. Pre-requirements for this course (if any):					
Chemical Kinetics - CHM 1348					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					

At the end of the course, Students should be able to:

- **The student will gain information about surface Chemistry: Solid surfaces and their characterization; Adsorption on solid surfaces: technique for measurement of adsorption from gas phase and solution; Langmuir, Freundlich and BET adsorption isotherm: Enthalpy of adsorption; Adsorption on liquid surface. Gibb's adsorption equation; Surface film; Electro-capillary phenomena.**
- **This includes initiation to catalysis specifically acid-base and enzymatic catalysis.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		**30**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To list the main concepts and applications of homogeneous and heterogeneous catalysis.**	**K1; K2; K3**	**Lecturing**	**Short quizzes**
1.2	**To recognize the concept of acid-base catalysis and proton transfer and describe the acid-base cycle and its industrial application.**	**K1; K2; K3**	**Solving problems, Homework and assignment**	**Homework and assignment marks and written exams**

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.3	To define surface chemistry and adsorption-desorption process, and list techniques for measurement of adsorption and surface area.	K1; K3	Discussions,	Quizzes and MCQs,
2.0	**Skills**			
2.1	• To differentiate homogenous and heterogeneous catalysis mechanisms, and estimate the kinetics and thermodynamic parameters of catalytic reactions and to calculate the adsorption parameters.	• S1; S2; S3 •	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions
2.2	• To analyze data and results through analytical thinking, with evaluation of the gained information.	• S1; S2; S3	Lectures	Homework assignment, Examination
2.3	• To demonstrate ability to participate in class by asking questions and giving answers.	• S3	Lecturing and oral discussion	Examination
2.4	• To show technical writing and oral communication skills through writing and oral presentation of mini-reports and	• S2; S3;	• Seminars • Encourage students to use electronic mailand blackboard to submit works	• Presentation marks • Oral tests • Assignments and homework

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	operate electronic mail and Network in communicating with others.		and assessments.	Laboratory reports and sheet
3.0	Values, autonomy, and responsibility			
3.1	To appraise collaborative work skill	V1, V2	• Group discussion, assignments and homework	• Oral tests, and sheets Marks • Assignments and homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction, Bulk, surface, Adsorption, adsorbate, adsorbent, Desorption, absorption, Physisorption, Chemisorption, surface area.	4
2.	Adsorption at Solid Liquid interface. Adsorption at Solid Gas interface, specific surface area.	6
3	Adsorption isotherm, Henry's equation, Freundlich isotherm, Langmuir isotherm, Potential theory of adsorption, Dubinin-Radushkevich.	4
4	Catalyst and catalysis, Types of catalysis, Classification of catalysis.	6
5	Characteristics of catalytic reactions, Catalytic promoters, Catalytic poisons.	4
6	Theories of catalysis. Biochemical or enzyme catalysis. Acid-base catalysis. Heterogeneous Catalysis. Industrial applications of catalysts	6
	Total	30
	Laboratory	
	None	

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam 1	6th week	20 %
2.	Midterm Exam 2	12th week	20 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	20 %
4.	Final Exam	16- 17th week	40 %
5.	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Principle of Colloids and Surface Chemistry. 3rd Edition Hiemenz and Raj Rajagopalan, CRC (1997). • Chemical Kinetics and Catalysis, R. A. van Santen and J. W. Niemantsverdriet, Springer Science + Business Media, LLC
Supportive References	• Principle of Colloids and Surface Chemistry. 4th Edition, Duncan J. Shaw, esc, PhD, FRS, Liverpool Polytechnic, (ISBN 07506 11820)
Electronic Materials	Blackboard
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.
Technology equipment (projector, smart board, software)	• The rooms are equipped with data show, Smart Board, WI-FI access.
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: Questionnaire.
	Course Responsible	Direct: Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Peer Reviewer	Direct: Questionnaire. Indirect: External assessor report.
Effectiveness of Students assessment	Program Leaders	Direct: Course e-Portfolio. Indirect: Course report.
Quality of learning resources	Students	Indirect: Second examiner checklist-Course report.
	Faculty (Academic Advisory)	Direct: course Entrance/Exit. Indirect: Observations - Accreditation review.
	Program Leaders	Direct: Course e-Portfolio. Indirect: Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	Course Responsible	Direct: Exams - Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Program Leaders	Indirect: Exams.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**7 (NO. 2/3)**
DATE	**29/3/1446 - 2/10/2024**