Course Specification

(Postgraduate Programs)

Course Title:	**Materials, Surfaces and Interfaces**
Course Code:	**CHM 6146**
Program:	Master of science in chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: 3 (3 Lectures, 0 Lab, 0 Tutorials)				
2. Course type				
A.	☐University	☐College	☐Department	☐Track
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered: Level 2/Year 1				

4. Course General Description:

This course presents the basis to identify the surface properties that influence interfacial reactions in metal and nonmetal systems. It includes the reactivity at the interfaces of different materials with some applications as biosensor and catalysis. The material section will include nanomaterials with the basic principles of surface science.

5. Pre-requirements for this course (if any):

Advanced Physical Chemistry – CHM 6141

6. Pre-requirements for this course (if any):

None

7. Course Main Objective(s):

- Improve their knowledge on surfaces and surfaces functions.
- Recognize the reactivity of Oxides in the solid-liquid interface.
- Develop their knowledge on the application of surface interface with catalysis and coordination chemistry as well Prebiotic Chemistry.
- Outline surface functionalization and its applications.
- Be familiar with Characterization Techniques of interface, surface and nanomaterials.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	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**	45
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)……**	0
	Total	45

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To describe the materials surface properties, Concept of Surface Sites, and the Reactivity of the interface.**	**K1. *Phy.*; K2. *Phy.*; K3. *Phy.***	▪ Five hours/week lectures. ▪ Self-study Home-exam.	▪ Regular Exams ▪ Assignments ▪ Short Quizzes ▪ Oral Discussion Participation.
1.2	**To list the Characterization Techniques and recognize the Surface functionalization.**	**K2. *Phy.*; K3. *Phy.***	▪ Five hours/week lectures. ▪ *Think* to justify the Characterization Techniques and the Surface functionalization, using available references (DSL) online Open discussion.	▪ Oral Discussion marks ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.
1.3	**To state the complements of**	**K2. *Phy.*; K3. *Phy.***	▪ Five hours/week lectures.	▪ Midterm. ▪ Assignments.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Characterization Techniques.		Group Discussion with mini-reports the complements of Characterization Techniques applications, using available references (DSL) online.	▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.4	**To recognize the application of surface interface with catalysis and coordination chemistry as well Prebiotic Chemistry.**	**K3. *Phy.***	▪ Five hours/week lectures. Group Discussion using available references (SDL) online.	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
2.0	**Skills**			
2.1	**To explain the concepts the materials Sciences and surface functionalization with its applications.**	**S1. *Phy.*; S2. *Phy*;**	▪ Lectures activity ▪ Self-study. Deep discussion on Materials Sciences and surface functionalization .	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions. ▪ Participation Mini -seminar.
2.2	**To analyze Characterization Techniques of interface, surface, and nanomaterials.**	**S2. *Phy*; S3. *Phy.***	▪ Practice some examples to analyze Characterizatio n Techniques of interface achieving ▪ Brainstorming. Self-study	▪ Questions in Lectures. ▪ Participation ▪ Oral Discussion Short Quizzes.
2.3	**To summarize Surface functionalization and its applications and roles.**	**S1. *Phy.*; S2. *Phy*.**	▪ Lectures ▪ Oral Discussions. ▪ Brainstorming. Self-study	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.4	**To operate communication to surfaces and surfaces functions, its applications in nanomaterials, and impact in KSA industrial sector accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.**	**S3. *Phy*; S4. *Phy*.**	▪ Group Discussion and Assignments. ▪ Suggest several examples of nanomaterials applications and impact in the KSA industry, for reading, writing, and oral presentation in group. Encourage students to use electronic mail to submit Home Exams and Assignments.	▪ Oral Discussion. ▪ Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. Marks given for Assignments.
3.0	**Values, autonomy, and responsibility**			
3.1	**To perform a scientific presentation, research, and work independently and integrate with a collaborated group, Using IT to acquire, analyze, and communicate information.**	**V1.*Phy*.**	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. Team work.	▪ Oral Discussion. ▪ Group Discussion ▪ Assignments.
3.2	**To demonstrate his ability to the effectively collaboration and inter-professionalism in class discussions or team works, as well as independently.**	**V1.*Phy.*; V2. *Phy*.**	▪ Small Group tasks ▪ Open discussion at classroom. ▪ Office hour guiding. Group Presentation of mini-projects	▪ Participation ▪ Homework's Mini-project(s).

C. Course Content:

No	List of Topics	Contact Hours
1.	***Introduction:*** General information on surfaces of powdered and bulk materials, nanosized materials, Industrial Issues, Concept of Surface Sites	4
2.	***Reactivity to the interface:*** Behavior of Oxides in the Solid-liquid Interface, Surface Charge and Reactivity with Respect to Electrostatic Adsorption. Example applications 1: Development of Heterogeneous Catalysts: Coordination Chemistry Interfacial Adsorption and Grafting, Adsorption Isotherms. Application Example 2: Prebiotic Chemistry, Amino Acids Adsorption.	8
3.	***Characterization Techniques:*** Physisorption Nitrogen, Electron Microscopy, X-ray Photoelectron Spectroscopy.	8
4.	***Surface functionalization:*** Concept of Self-Assembled Monolayers, Grafting, Liaison Officers, Vibration Spectroscopy on Flat Surfaces. Application Example 3: Biosensor, a Physical Chemist Approach Biomolecules, Molecular Recognition. Application Example 4: Surface Anti-biofilm, how to Inhibit Adsorption?	8
5	***Characterization Techniques:*** IR Spectroscopy Surface, Near Field Microscopy.	6
6	***Nanomaterials:*** From Micro to Nano, the Effects of the Nanoscale. Study of Gold Nanoparticles, Biological and Catalytic Applications.	6
7	***Characterization techniques:*** Raman Spectroscopy, and Raman Exalted Surface.	5
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)**	**weekly**	**30 %**
2.	**Midterm Exam**	**9th week**	**30 %**
3.	**Final Exam**	**17 th week**	**40 %**
4.	**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	***Chemical Properties of Material Surfaces***, Kosmulski, M. CRC Press, 2011. ISBN 9780824705602 - CAT# DK1803 ***Encyclopedia of Materials Characterization: Surfaces, Interfaces, Thin Films*** (Materials Characterization Series), Evans, Ch.; Brundle, R. Butterworth-Heinemann, W 1992.ISBN: 978-0-08-052360-6
Supportive References	• ***Handbook of Surfaces and Interfaces of Materials***, Five-Volume Set, H. Nalwa, 2001, Academic Press, ISBN: 9780125139106 Saudi Digital Library
Electronic Materials	Saudi Digital Library**.**
Other Learning Materials	• Blackboard • Multimedia associated with the text book and the relevant websites.

3. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Each of the classroom 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.

Assessment Areas/Issues	Assessor	Assessment Methods
		Indirect: Course report.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory-GCC)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	
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.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Council of Chemistry Department
REFERENCE NO.	10 (No. 2/10)
DATE	21/04/1444- 15/11/2022