Course Specification
(Bachelor)

Course Title:	**Nanochemistry**
Course Code:	**CHM 1449**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	2024 V 1
Last Revision Date:	19 October 2024

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A. General information about the course:

1. Course Identification

1. Credit hours: 2 (2 Lectures, 0 Tutorials, 0 Lab)					
2 (2 Lectures, 0 Tutorials, 0 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: Level 7 / Year 4					
4. Course general Description:					
The course covers the following topics: Inorganic Materials Chemistry and Nanochemistry; Basics Nanomaterials, Nanoparticles: Types, compositions, and structures. The course will extend to Metal and semiconductor nanocrystals, Porous inorganic nanoparticles, Organic nanoparticles. It also designed to cover Optical characterization and structural characterization.					
5. Pre-requirements for this course (if any)**:**					
Electrochemistry and Corrosion / CHM 1343					
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 recognize the basic information of nanochemistry and nanomaterials concepts and their applications.**
- **To describe the concept of nanomaterials preparation**
- **To state the application of nanochemistry and nanotechnology in the industrial field.**
- **To outline the physical and chemical characterization of nanomaterials.**
- **To differentiate between the different types of nanomaterials.**
- **To predict the physical properties of nanomaterials.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**30**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**
4	Distance learning	**0**	**0**

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 recognize the basic information of nanochemistry and nanomaterials concepts and their applications.**	**K1; K2; K3**	• Two hours are weekly, containing lectures. • A Private study, including work on the home exam. ▪	▪ Quizzes ▪ Assignments ▪ Oral Discussion ▪ Participation.
1.2	**To describe the concept of nanomaterials preparation**	**K1; K2; K3**	• Two weekly hours, lectures • Group discussion	• Assignments. • Quizzes. • Final exam.
1.3	**To state the application of nanochemistry and nanotechnology in the industrial field.**	**K1**	• Group discussions. • A Private study, including work on homework. ▪ Think and outline nanochemistry and nanotechnology impact	• Midterms. • Assignments. • Oral test • Quizzes. • Final exam.
1.4	**To outline the physical and chemical characterization of nanomaterials.**	**K1; K3**	• Two hours are weekly, containing lectures. • A Private study, including work on the home exam.	▪ Quizzes ▪ Assignments ▪ Oral Discussion ▪ Participation. ▪

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
			▪	
2.0	**Skills**			
2.1	**To differentiate between the different types of nanomaterials, and summarize the nanomaterials synthesis.**	**S1, S2, S3,**	• Lectures activity • Think and talk about types of nanomaterials synthesis.	• Questions in Lectures. • Short Quizzes and Exams. • Participation through Classwork and Homework.
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1, S2, S3**	Introduce some examples of the nanomaterials IMPACT	• Questions in Lectures. • Short Quizzes and Exams. • Participation • Oral Discussion and Homework.
2.3	**To develop oral and network communication, technical writing skills through writing, oral presentation of mini reports**	**S3**	Lectures activity	• Questions in Lectures. • Short Quizzes and Exams. • Participation. Oral Discussion and Homework
3.0	**Values, autonomy, and responsibility**			
3.1	**To illustrate teamwork, make a decision, and maintain scientific integrity during different assessments, projects, and mini-reports.**	**V1, V2**	• Seminars • Group discussion and assignments • Homeworks • Mini reports	• Presentation marks • Oral tests • Assignments and homeworks • Mini reports assignment

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to nanochemistry**: Inorganic Materials Chemistry and Nanochemistry; Basics Nanomaterials, Nanoparticles: Types, compositions, and structures.	6

2	**Metal and semiconductor nanocrystals**: Porous inorganic nanoparticles, Organic (latexes), Carbon-based nanoparticles (carbon nanotubes, grapheme), Porous inorganic nanoparticles, Organic (latexes) and carbon-based nanoparticles (carbon nanotubes, graphene), Nanoparticle synthesis: Basic synthesis and fabrication methods for nanomaterials (CVD, sol-gel, microemulsion, template, hydrothermal) , Classical Colloid Theory: Nucleation and growth, Ostwald ripening, Homogeneous vs. heterogeneous nucleation, Applications of nanomaterials, Anisotropic growth and shape control, Catalyzed (seeded) growth, Nanocrystal doping, solid solutions and Vegard's rule	12
3	**Optical characterization**: Absorption and photoluminescence (PL & PLE) spectroscopies, steady-state vs. fast spectroscopy, dynamic light scattering **Structural characterization**: XRD, TEM, AFM, Deviations between bulk and near-surface crystal structures **Chemistry of small surfaces**: Curvature and neighboring-charge effects on chemical reactivity and equilibria (pKa's, redox potentials) **Applications in structural materials**, imaging, lighting, energy conversion (Solar Cells), catalysis and Photocatalysis (Environmental remediation) and Nano-electronics/Nano-photonics Applications Environmental, safety, and ethical aspects of nanotechnology	12
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, Attendance, Participation, Home Exams	All the semester	20 %
2.	Midterm Exam 1	Around 6th & 7th week	20 %
3.	Midterm Exam 2	Around 11th & 12th week	20 %
4.	Final Exam	Around 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	***Nanochemistry,*** G.B. Sergeev, K.J. Klabunde, Elsevier, 2013, ISBN: 978-0-444-59397-9
Supportive References	***Nanoscale Science and Technology,*** Robert Kelsall, Ian W. Hamley , Mark Geoghegan, Wiley | 2005-04-29 | ISBN: 0470850868 ***Nanomaterials and Nanochemistry,*** C Brechignac, P Houdy, M Lahmani2011, Wiley, ISBN: 0444593977
Electronic Materials	**Blackboard**
Other Learning Materials	• **None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Each classroom is equipped with PC and retro projector with a maximum of 25 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.

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