

نموذج توصيف مقرر
Course Description Form

Name of College\Faculty : Science

Name of Department: Chemistry

اسم الكلية:

اسم القسم العلمي:

Course Name	Chemistry of Nanomaterials	اسم المقرر
Course No.	0420422	رقم المقرر
No. of Credits	3	عدد الوحدات
Theoretical Hours	3	عدد الساعات النظرية
Practical Hours	0	عدد الساعات المحلية
Course topics	مواضيع المقرر	
1. Introduction to nanostructures and nanomaterials. 2. Physical chemistry of solid surfaces. 3. Nanomaterial’s synthesis and fabrication techniques. 4. Characterization techniques used for nanomaterials. 5. Relation between the structure and properties of nanomaterials. 6. Applications of nanomaterial.		
Text book: (Name, Author , Year , Publisher)		عنوان الكتاب : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)
Nanostructures and Nanomaterials, By Guozhong Cao and Ying Wang, World Scientific, <u>Latest edition</u> .		
References: (Name , Author , Year . Publisher)		عنوان المرجع : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)
Understanding nanomaterials, By Malkiat S. Johal and Lewis E. Johnson. CRC press, Taylor, and Francis Group. <u>Latest edition</u> .		

Prerequisites				متطلبات المقرر		
	Exams	50	%		الاختبارات	
	Quizzes	10	%		امتحانات قصيرة	

Grading	H.W.	0	%		واجبات	آلية رصد المقرر
	Project (field study)	0	%		مشاريع (دراسة ميدانية)	
	Final	40	%		الاختبار النهائي	
	100%					

Chapters included:

Chapter	Topic	Pages
CH.1	Introduction to nanostructures and nanomaterials.	1-14
CH.2	Physical chemistry of solid surfaces.	15-48
CH.3	Nanomaterial's synthesis and fabrication techniques.	277-322
CH.4	Characterization techniques used for nanomaterials.	329-350
CH.5	Relation between the structure and properties of nanomaterials	352-384
CH.6	Applications of nanomaterials.	391-412

Course objectives					
No.	Course Objectives (Learning Outcomes)	Example(s) of relevant (Topics and activities)	Recommended Level to satisfy the objectives		
			High	Medium	Low
1	To expose the students to the main techniques used for the synthesis and fabrication of nanomaterials.	- Introduce and define nanoscience and nanotechnology. - Explain why nanotechnology is important. - Explain the essential approaches used for the synthesis of nanomaterial and fabrication of nanostructure. - State the major challenges associated with	X		



		nanostructures and nanomaterials. • Illustrate the top-down approach for nanostructures fabrication by various physical techniques. • Explain the fundamentals of several physical techniques applied for fabricating nanostructures such as lithographic, nanomanipulation and nanolithography, soft lithography, and self-assembly.			
2	To expose the students to the main concepts of physical chemistry of solid surfaces.	• Discuss the basics of the physical chemistry of solid surfaces. • Explain the concept of surface energy and how to reduce its magnitude for the nanomaterials. • Interpret the dependence of the chemical potential on the radius of curvature of the surface. • Describe the major stabilization mechanism i.e., electrostatic and steric for the nanoparticles in addition to the main factors that influence each mechanism. • Outline the advantages of steric stabilization over the electrostatic stabilization mechanism.	X		
3	To explain to the students the relationship between the structure and properties of nanomaterials.	• Introduce synthesis and processing of zero-dimensional nanostructures. • Discuss the fundamentals of homogeneous and heterogeneous nucleation mechanisms and the	X		



		growth process of nanoparticles. - Describe the synthesis of metallic, semiconductor and oxide nanoparticles and the factors that control the size, distribution, and chemical composition of the particles. - Discuss the major confinement methods used for nanoparticles.			
4	To teach the students the main characterization techniques used for nanomaterials.	- Introduce synthesis and processing of one-dimensional nanostructures. - Discuss the fundamentals and approaches for nanowires and nanorods synthesis and their growth such as spontaneous growth, template-based synthesis, electrospinning, and lithography. - Introduce the fundamental principles of the characterization methods and physical properties of nanomaterials. - Discuss the basics of the structural characterization techniques (e.g. X-ray diffraction(XRD), small angle X-ray Scattering (SAXS), scanning and transmission electron microscopy (SEM/TEM), and various scanning probe microscopy (SPM). - Discuss the basics of the chemical characterization techniques (e.g. electron spectroscopy, ion spectroscopy, and optical spectroscopy).	X		



		Discuss the major physical properties of nanomaterials such as thermal, mechanical, optical, electrical, and magnetic properties.			
5	To brief the students about major applications of nanomaterials in the field of technology and their future prospects.	- Introduce synthesis and processing of two-dimensional nanostructures. - Discuss the fundamentals and approaches for thin film deposition and growth. - Explain the principle of vapor phase deposition (e.g. evaporation, molecular beam epitaxy (MBE), sputtering, chemical vapor deposition (CVD), and atomic layer deposition (ALD)) - Explain the principle of liquid-based growth (e.g. electrochemical deposition, chemical solution deposition (CSD), Langmuir-Blodgett films, and self-assembled monolayers (SAMs))	X		
6	To illustrate modern techniques for characterization of some selected catalytic surfaces.	To write a short report and give a talk on contemporary topics related to nanoscience.	X		
Fields	Physical Chemistry				
Skills					
Coordinator (Name and Rank):	Physical Chemistry Coordinator				
Signature and stamp :					
Date:	10/11/2025				