



SYLLABUS

A. Course Description

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
CHM	449	Nanochemistry	2	2	0	0	4	CHM 345	8	English

This course deals 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. Synthesis methods, applications of nanoparticles. At the end of this course the student will be able to

- recognize the basic information of nanochemistry and nanomaterials concepts and their applications.
- describe the concept of nanomaterials preparation
- state the application of nanochemistry and nanotechnology in the industrial field.
- outline the physical and chemical characterization of nanomaterials.
- differentiate between the different types of nanomaterials.
- predict the physical properties of nanomaterials.

B. References: Required Textbook & Internal Website

I shall use

Nanochemistry, G.B. Sergeev, K.J. Klabunde, Elsevier, (2nd Ed.), 2013, ISBN: 978-0-444-59397-9. **Students are required to purchase the textbook/materials (it is an obligation).** The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook. Other references:

- ***Nanoscale Science and Technology***, Robert Kelsall, Ian W. Hamley, Mark Geoghegan, (1st Ed.), Wiley 2005, ISBN: 0470850868

Google Classroom Webpage: <http://www.imamm.org/>

C. Topics Outline

Disclaimer: this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

- 1. Introduction to nanochemistry:** Inorganic Materials Chemistry and Nanochemistry; Basics Nanomaterials, Nanoparticles: Types, compositions, and structures.
- 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.

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 Nanoelectronics/Nanophotonics Applications Environmental, safety, and ethical aspects of nanotechnology

D. Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word “semi-official” entails, can be found here:

- **Midterm 1:** 6th or 7th week & **Midterm 2:** 11th or 12th week
- **Quizzes:** 2 Quizzes
- **Homework:** 4 Homework
- **Final Exam:** 16th week

	Teaching/learning activities	Contact Hours	Frequency	Total Contact hours	Self-study hours (hrs)	Total self-study hours	Student Learning Time
1	Lecture	2	15	30	2	30	60
2	Tutorial	0	0	0	0	0	0
3	Lab\Practical	0	0	0	0	0	0
4	Lab report	0	0	0	0	0	0
5	Lab Exam	0	0	0	0	0	0
6	Homework	0	4	0	2	8	8
7	Quiz	0.25	2	0.5	1	2	2.5
8	Test (Midterm)	1.5	2	3	8	8	11
9	Final Exam	2	1	2	9	9	11
Total				35.5		57	92.5

- **Independent self-study = 57 / 15 \cong 4 hrs per week (as average)**

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

Midterm 1: 20 %	Midterm 2: 20 %	Final Exam: 40 %
Quizzes; Homework & Attendance & Participation: 20 %		



Grading distribution:

A+: [95, 100], A: [90, 95), B+: [85, 90), B: [80, 85), C+: [75, 80), C: [70, 75), D+: [65, 70), D: [60, 65), F: [0, 60).

E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Exams](https://Examsgoo.gl/ykm7t3)
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