

Syllabus MAT 406 – Spring 2023

We may have to revise the course plan according to the countrywide reassessment to be made regarding higher education. This is expected to happen at the beginning of April. The content to be delivered is certain, but the method of course delivery, the number and dates of exams, and some other details are subject to change.

• Instructor

Fevzi Ç. Cebeci

FENS 2069

Phone: 9877

• Course Meeting Times.

Scheduled Meeting Times

Classroom: FENS L055 Tuesday 14:40 - 17.30 3h block **Online Only**

Zoom Link: <https://sabanciuniv.zoom.us/j/93431117503>

I will update this syllabus during the semester. Please check frequently.

Laboratory: TBA Tuesday 14:40 - 17.30 3h block **Face-to-Face only**

I will announce the laboratory number before the scheduled experiment.

• Office Hours

I scheduled weekly office hours. The Zoom link is below. Additionally, on-demand office hours will be scheduled according to student requests.

1 Session/week; Wednesday 1h 15:40 - 16.30 **Online/ Face-to-Face**

Zoom Link: <https://sabanciuniv.zoom.us/j/95554267448>

Meeting ID: 955 5426 7448

Passcode: Meet_M406

• Teaching Assistant

Ekin Berksun

Amin Ranjbar Aghjehkohal

• Course Objective and LOs

Objective

To expose the students to different fabrication techniques of nanosystems and nanomaterials.

Learning Outcomes

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

- list several different fabrication methods for nanomaterials
- differentiate between bottom-up and top-down fabrication approaches
- given the desired properties of a nanosystem, determine which fabrication method to use
- list the advantages and disadvantages of common fabrication techniques and compare them to other techniques

• **Calendar.**

Week #	Tuesday 3h Lecture	Notes
1	28.Feb	Introduction
2	7.Mar	Topic 1
3	14.Mar	Topic 2
4	21.Mar	Topic 3
5	28.Mar	Topic 4
6	4.Apr	Topic 5
7	11.Apr	Topic 6
8	18.Apr	Lab #1
9	25.Apr	Lab #2
10	2.May	Lab #3
11	9.May	Lab #4
12	16.May	Lab #5
13	23.May	Lab #6
14	30.May	Review

• **Lectures.**

Week Lecture and Laboratory Plan

- 1 **Lecture:** Introduction to nano systems fabrication methods; properties of nano materials
- 2 **Lecture:** Carbon based materials; CNT fabrication, Graphene, (e-beam evaporation) (Lab #1)
- 3 **Lecture:** Electrospinning (Lab #2)
Lecture: Synthesis of Nanomaterials & Nanostructures: Nanoparticles, Nanorods, Nanorods, Nanowires, MOFs, Quatum Dots (Lab #5)
- 4 **Lecture:** Self Assembly; Soft Lithography (Lab #4)
- 6 **Lecture:** Nanocomposites & Nanoelectrochemistry (Lab #3)
- 7 **Lecture:** Lithography; Gas-phase fabrication methods; ex. CVD, MOCVD, ALD (Lab #6)
- 8 **Take-Home Exam Due Date April 17**
- 8 **Lab #1:** VA-CNT Forest Growth
Work-up of Experiment #1
- 9 **Lab #2:** Electrospinning
Work-up of Experiment #2
- 10 **Lab #3:** Synthesis of Nanoparticles; Carbon dots
Work-up of Experiment #3
- 11 **Assingment#1 Due date May 8**
Lab #4: Layer by Layer Assembly
- 12 Work-up of Experiment #4
Lab #5: Nanocomposites or Nanoelectrochemistry
- 13 Work-up of Experiment #5
Lab #6: Ebeam Evaporation
Work-up of Experiment #6
- 14 **Assingment#1 Due date May 29**
Review

- **Textbooks & Reading.**

There is no official textbook for the course, and the following references are helpful.

- Introduction to Nanoscience, S. M. Lindsay, Oxford.
- Introduction to Nanoscience and Nanotechnology, G.L. Hornyak, H.F. Tibbals, J. Dutta, J.J. Moore, CRC Press.
- Nanotechnology: synthesis to applications / edited by Sunipa Roy, Chandan Kumar Ghosh, and Chandan Kumar Sarkar
- Nanotechnology past and present: leading to science, engineering, and technology / Deb Newberry
- Nanotechnology: understanding small systems / Ben Rogers, Jesse Adams, Sumita Pennathur

- **Grading**

We will have one midterm exam, and we don't have a final examination; most of your grades will come from lab experiments. I will consider five of your lab studies and exclude the one with the lowest grade or the missing lab. There won't be a makeup lab session, so you should consider the 6th lab as the makeup. You must attend at least four laboratory experiments. You will fail the course if you attend fewer than four experiments.

No Makeup Exam (except in medical emergencies)

Activities	Percentages
Lab Experiments	50 %
Midterm Exam	30 %
Assignments	20 %

- **Attendance**

Attendance is essential, and you are expected to attend at least four lab sessions; otherwise, you will fail. You are expected to attend at least 75% of the classes.

- **Appendix 1: Course Catalogue Information**

MAT 406 Nanoengineered Systems Fabrication

MAT406 will detail top-down and bottom-up approaches for nanoengineered systems fabrication. It covers nanolithography/nanofabrication techniques, the fundamentals of shaping materials, nanoscale, lithography, nanoimprint lithography, step-and-flash lithography, unconventional fabrication techniques, charged particle lithography, and metrology: etching, patterning, and pattern transfer. Bottom-up approaches include CVD, ALD, surface functionalization, and patterning. Self-assembly techniques, like atomic, polymeric, colloidal, biological, and interfacial. 3D printing. Nanostructured materials synthesis as building blocks of nanosystems such as; nanoparticles, nanotubes, nanosheets, vesicles, wires, etc. Nanomedicine, drug delivery systems, and nanosystems for clinical diagnostics. Health and safety aspects of nanoengineering fabrication methods.

MAT 406 Nanotasarlanmış Sistemlerin Üretimi

MAT406 ile nanotasarlanmış sistemlerin üretimi için aşağıdan yukarıya ve yukarıdan aşağıya olan yöntemler detaylandırılacaktır. Bu derste incelenecek konular; nanolitografi/nanotüretim teknikleri, malzemelerin şekillendirilmesinin temelleri, nanoboyutta litografi, basamak ve flaş litografi, geleneksel olmayan litografi teknikleri, yüklü parçacıkların litografisi ve metroloji. Aşındırma, örüntüleme ve örüntü transferi. Aşağıda yukarı teknikler, örneğin, CVD, ALD, yüzey fonksiyonlandırma ve örüntü oluşturma. 3D baskı. Nanosistemlerde kullanılmak üzere nanoyapılı malzemelerin sentezleri örneğin, nanoparçacık, nanotüp, kese, tel vb. Nanotipteki uygulamalar, ilaç iletim sistemleri ve klinik tanı için nanosistemler. Nanomühendislik üretim yöntemlerinin sağlık ve güvenlik açısından değerlendirilmesi

Prerequisite: NS 218 - Undergraduate - Min Grade D

ECTS Credit: 5 ECTS (6 ECTS for students admitted before the 2013-14 Academic Year)

General Requirements:

• Appendix 2: ACADEMIC INTEGRITY AT SABANCI UNIVERSITY

Investigation procedures for academic integrity violations:

Violations of academic integrity include cheating in classroom examinations, plagiarism in take-home examinations, homework assignments, essays, thesis, and artistic work, fabrication and misrepresentation of facts and data, as well as assistance to others in commission of these acts, spontaneous or premeditated. These violations undermine values of fairness, honesty and trust in the academic environment and distort the process by which knowledge is shared and evaluated. The academic integrity investigation procedure is a fundamental component of our commitment to maintain a productive climate of learning and a vibrant academic life.

A student whose work or behavior is considered to have contravened the principles of academic integrity faces academic consequences. These are determined by the course instructor or the thesis supervisor in accordance with our academic norms. **The academic integrity policy for each course is appended to the syllabus and announced to the students at the beginning of the course.**

The disciplinary procedure outlined below is independent of the academic consequences of the violation.

1. The students, teaching assistants and proctors in a learning module or course must communicate any information and observation about academic integrity violations to the main instructor.
2. The main instructor personally reports all incidences with preponderance of evidence for violations of academic integrity, **without exceptions**, to the Dean or the Director's office. The report consists of a written statement of facts and evidence. The case is recorded. Please use the attached form.
3. If necessary, the Dean/Director interviews the parties involved and decides on whether to initiate a further disciplinary investigation.
4. The further disciplinary investigation is carried out according to the regular procedures of the university.

The duty to report violations, highlighted in the above procedure, is inseparable from our responsibility to take action against wrongdoing, even in situations involving peer pressure, fear or compassion. The requirement that all cases be reported to the Dean/Director's office ensures fairness through a uniform application of rules across all cases. It also strongly signals our community's determination to defend the academic values of honesty and mutual trust.