

Syllabus MAT 406 – Spring 2021-2022

• Instructor

Fevzi Ç. Cebeci

FENS2069

Phone: 9877

• Course Meeting Times.

1 Sessions/week; Thursday 3h 14:40 am - 17.30 pm **Hybrid**

Classroom: FENS L030

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

Meeting ID: 955 5426 7448

Passcode: Meet_M406

I will update this syllabus depending on the pandemic situation for lab sessions. Please check frequently.

Laboratory: TBA; Thursday 3h 14:40 am - 17.30 pm **Face-to-Face only.**

• Office Hours

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

1 Sessions/week; Wednesday 1h 15:40 pm - 16.30 pm T Online

Zoom Link: <https://sabanciuniv.zoom.us/j/99334317294>

• Teaching Assistant

Ekin Berksun

• 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 advantages and disadvantages of common fabrication techniques and compare them to other techniques

• **Calendar.**

	R	Notes
Week #	3h Lecture	
1	3.Mar	Introduction
2	10.Mar	Topic 1
3	17.Mar	Lab #1
4	24.Mar	Topic 2
5	31.Mar	Lab #2
6	7.Apr	Topic 3
7	14.Apr	Lab #3
8	21.Apr	Topic 4
9	28.Apr	Lab #4
10	5.May	Break
11	12.May	Exam
12	19.May	N. Holiday
13	26.May	Topic 5
14	2.Jun	Lab #5
15	9.Jun	Topic 6

• **Lectures.**

Lecture and Laboratory Plan

- 1 **Lecture:** Introduction to nanosystems fabrication methods; properties of nanomaterials
- 2 **Lecture:** Carbon-based materials; CNT fabrication, Graphene (e-beam evaporation)
- 3 **Lab #1:** VA-CNT Forest Growth
Work-up of Experiment #1
- 4 **Lecture:** Electrospinning
- 5 **Lab #2:** Electrospinning
Work-up of Experiment #2
Lecture: Synthesis of Nanomaterials & Nanostructures: Nanoparticles, Nanorods, Nanorods,
- 6 Nanowires, MOFs, Quantum Dots
- 7 **Lab #3:** Synthesis of Nanoparticles; Carbon dots
Work-up of Experiment #3
- 8 **Lecture:** Self Assembly; Soft Lithography
- 9 **Lab #4:** Layer by Layer Assembly
Work-up of Experiment #4
- 10 Break
- 11 **Midterm Exam**
- 12 **National Holiday**
- 13 **Lecture:** Nanocomposites & Nanoelectrochemistry
- 14 **Lab #5:** Nanocomposites or Nanoelectrochemistry
Work-up of Experiment #5
- 15 **Lecture:** Lithography; Gas-phase fabrication methods; ex. CVD, MOCVD, ALD
Assignment Due date June 09

- **Textbooks & Reading.**

There is no official textbook for the course, and the following references are pretty 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 a midterm exam, but there will be 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 *5th* lab as the makeup.

No Makeup Exam (except medical emergencies)

Activities	Percentages
Lab Experiments	60 %
Midterm Exam	30 %
Assignment	10 %

- **Attendance**

Attendance is quite 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 particles lithography, and metrology. Etching, patterning and pattern transfer. Bottom-up approaches, such as CVD, ALD, surface functionalization and patterning. Self-assembly techniques, like atomic, polymeric, colloidal, biological, interfacial. 3D printing. Nanostructured materials synthesis as building blocks of nanosystems such as; nanoparticles, nanotube, nanosheet, vesicle, wire 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 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.