Syllabus MAT 406 – Spring 2020-2021

- **Lecturer**

Fevzi Ç. Cebeci FENS2069 Phone: 9877

- **Course Meeting Times.**

1 Sessions/week; Wednesday 3h 10:40 am - 1.30 pm W Online

Zoom Link: https://sabanciuniv.zoom.us/my/fevzi.cebeci

Starting from the 8th week (April 14, 2021), we hope to continue face-to-face education; I will update this syllabus accordingly. Please check frequently, and we will continue as follows.

1 Sessions/week; Wednesday 3h 10:40 am - 1.30 pm W G029

- **Office Hours**

Two office hours per week is scheduled; additionally, on-demand office hours will be scheduled according to student requests.

1 Sessions/week; Wednesday 2h 1:40 pm - 3.30 pm W Online

- **Teaching Assistant**

Deniz KÖKEN

- **Course Objective and LOs**

Objective
To expose the students to different fabrication techniques of nano systems and nano materials.

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

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

- **Calendar.**

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

- **Lectures.**

Week 1 : Introduction to nano systems fabrication methods; properties of nano materials
Week 2 : Carbon based materials; CNT fabrication, Graphene & e-beam evaporation
Week 3 : Nanoelectrochemistry
Week 4 : Synthesis of Nanomaterials & Nanostructures: Nanoparticles, Nanorods, Nanorods, Nanowires, MOFs, Quantum Dots
Week 5 : Self Assembly & Soft Lithography
Week 6 : Lithography & Gas-phase fabrication methods; ex. CVD, MOCVD, ALD
Week 7 : Electrospining & Nanocomposites

Week 8 : Pre-Lab Studies; Fundamentals; Techniques; Characterizations
Lab #1: VA-CNT Forest Growth
Week 9 : Lab #2: Synthesis of Nanoparticles; Carbon dots
Work-up of Experiment #1
Week 10 : Lab #3: Nanocomposites or Nanoelectrochemistry
Work-up of Experiment #2
Week 11 : Lab #4: Layer by Layer Assembly
Work-up of Experiment #3

Week 12 : National Public Holiday
Week 13 : National Public Holiday

Week 14 : Lab #5: Electrospining

- **Textbooks & Reading.**

There is no official textbook to the course, following references are quite 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 won't have midterm, 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 exam, so you should consider *5th* lab as the make-up. Attendance will be quite important.

No Make-up Exam (except medical emergencies)

Activities	Percentages
Lab Experiments	60 %
Final Exam	30 %
Week 14 presentation/discussion	10 %

- **Attendance**

Students are expected to attend at least 75% of the classes (27h out 36h) to take the final exam.

- **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 nanolitography / 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 and patterning. Self-assembly techniques, like atomic, polymeric, colloidal, biological, interfacial. 3D printing. Nanostructured materials synthesis as building blocks of nanosystems such as; nanoparticle, 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, malzemelerın 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. Nanotıptaki 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 from 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 further disciplinary investigation.
4. 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.