# MTEN 702: Spring 2025 Nanoporous Materials

Instructor: Dr. Gennady Gor, Associate Professor web: http://porousmaterials.net Office/Lab: 357/321A Tiernan Hall, Phone: 973-596-2944, E-mail: gor@njit.edu Class: Friday, 1:00-3:50 PM; Room: KUPF 210 Office Hours: by appointment only

## **Course Objectives**

The objective of this course is to introduce PhD students to problems related to nanoporous materials, and phenomena important to their technological applications, with the primary focus on gas adsorption. Additionally, the course covers mechanical properties of nanoporous materials, and the thermodynamics of fluids confined in the pores. In addition to introducing PhD students to well-established knowledge on nanoporous materials, the course aims to familiarize them with the most recent research in this field.

## **Course Description and Requirements**

The course is designed for Ph.D. students only. Outstanding MS students in physics, chemistry and engineering should reach out to the instructor for permission to register as an exception.

**Pre-Requisites:** As a special topic course, this course does not have formal pre-requisites. However, the course requires background in thermodynamics at the graduate level, and background in math (calculus and differential equations) and mechanics at an undergraduate level. The students are expected to be proficient with software for engineering calculations and plotting (preferably Python or Matlab, at minimum Excel).

**Format:** This course is taught in the in-person format. The course consists of lectures and seminars/discussions, including students' presentations.

### Learning Materials

Course webpage on Canvas: https://njit.instructure.com/courses/48018. All the updates and assignments will be posted on Canvas webpage.

**Textbook:** There is no required textbook. This is a research-based graduate course, there is no textbook that covers the course material.

Other Learning Material: The list of articles for the course will be provided.

## **Course Topics**

The order of the topics listed here does not represent the order in which they are presented in class, neither this list is exhaustive.

- Gas adsorption by nanoporous materials
- Mechanics of nanoporous materials
- Fluid transport in nanoporous materials
- Basics of poroelasticity
- Polymers viewed as nanoporous materials
- Thermodynamics of nanoconfined fluids

### Assessment and Grading

**Homework:** Homework assignments will be given regularly (up to 10 per semester). Assignments will be of two types – reading and calculations/derivations. The assignments will be posted on Canvas.

Grades

А

В

C

F

B+

C+

Points

4.0

3.5

3.0

2.5

2.0

0.0

			Percent
Homeworks	20%		above $85\%$
Midterm project	30%		above $75\%$
Final Project	35%		above $65\%$
Participation	15%		above $55\%$
	100%		above $45\%$
		-	below $45\%$

<b>Exams:</b> There will be two exams in the form of the research mini-projects. The projects will
be implemented in teams of 2-4 students. The individual grade for each of the team members
will be calculated as the team grade, multiplied by the participation coefficient calculated
based on peer-evaluations from all the team members.

The midterm exam (project) will be based on critical analysis of the literature on one of the course topics. The literature will be assigned by the instructor. The assignment will include reading the literature, analyzing the literature data, performing calculations, and writing a report (using  $ET_EX$ ). The grade will take into account all the aspects of the assignment. If time permits, in-class presentation will be also included.

The final exam (project) will be an open-ended problem within the scope of interests of Laboratory for Materials Interfaces. The assignment will include reading the literature, analyzing the literature data, performing calculations, and writing a report (using IATEX). The grade will take into account all the aspects of the assignment. If time permits, in-class presentation will be also included. Note that outstanding final reports can be developed into publishable research papers. The final projects from the different graduate elective course, taught by the same instructor, ChE 775 in 2020 and 2022, led to papers published in J. Phys. Chem. B https://doi.org/10.1021/acs.jpcb.0c10505 and ACS Appl. Mater. Interfaces https://doi.org/10.1021/acsami.3c02713

## Policies

#### Academic Integrity

Quotation from the Provost email on Academic Integrity: "Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu."

- Any violations of academic integrity will be reported to the Dean of Students
- Any collaboration is prohibited unless explicitly stated in the assignment
- If a team assignment assumes team work, the contributions of all team members should be clearly stated
- Students cannot share any of the course materials (including assignments), with anyone outside the class, or post any of the materials on the Internet without an explicit permission from the instructor

#### Generative AI

Student use of artificial intelligence (AI) is not permitted in this course for any in-class activities/assignments. It is permitted to be used in the homework assignments and exams, however, it is discouraged. Furthermore, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

#### Excused and Unexcused Absences

- Attendance is required and will be taken during every class.
- If a student misses a class without an excused absence, they lose 3% of participation points for each missed class. Five missed classes will nullify any participation.
- The following reasons are accepted as excused absences, and do not require documentation (unless more than one class is missed): (1) Medical, (2) Research, (3) Religious observance.
- Medical. If a student is sick with cold/flu/COVID symptoms, they should not come to class. If missing one class, an email to the instructor stating that the absence has a medical reason is sufficient. If missing more than one class, a documentation should be provided to the Dean of Students.
- Research. Conference participation, field experiment, and other research-related absences are considered excused. If missing one class, an email to the instructor stating the absence is research-related is sufficient.

• Student Absences for Religious Observance. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally, by the end of the second week of classes and no later than two weeks before the anticipated absence. Only in this case, it will be considered as an excused absence, and make-up assignments will be given similarly to any other excused absence.

#### Lectures

- The classes start at 1:00PM, and the students must be in class by that time.
- If a student is late to the class and comes after the attendance is taken, they are counted as absent for participation.
- Electronic devices are not permitted during the classes. No audio or video recording is allowed.
- Exceptions can be requested for using tablets/laptops for note taking.
- Cellphones should be turned off during both regular classes and exams and not allowed under any circumstances.
- Food is not allowed any time during the classes.

### Course materials, office hours and correspondence

- The course Canvas page is the main platform for delivering information about the course. All relevant course materials and assignments will be posted on Canvas, so a student should check it regularly.
- The students have to upload a professional-looking head shot for their Canvas profile.
- All the communications should be done via email (not Canvas), emails will be responded within 24 hours during the working days.
- E-mail correspondence is intended only for quick questions. Questions which require a detailed discussion should be discussed during the Office Hours.
- All correspondence should be conducted in a professional style, using formal English.
- To assure quick response to your emails, please add "MTEN 702" in the subject of your emails.

### Exams, Homeworks and Grades

- The homework must be completed by 11:59PM a day before the next class, unless otherwise explicitly stated. Late assignments will be accepted with a penalty of 20% for each day (full or partial) they are late. If the solution for assigned problem has been posted or discussed in class, late assignment will not be accepted.
- For the hand-written assignments (e.g. homeworks) it is the student responsibility to write it legible. If an assignment cannot be read, it will result in a score of 0.
- A letter grade is based on the final score, calculated using an Excel spreadsheet in accordance with the Tables given in this syllabus. The assigned letter grade is final and cannot be negotiated.
- A student can dispute the exam scores within a week after the announcement of the score. Exam scores can be disputed during the official Office Hours, not during class time or via email.

- If students miss an exam due to extreme circumstances (such as a medical problem), they need to notify the instructor via email before the beginning of the exam, and bring proof of the circumstance to the Dean of Student's office. Only with an official approval from the Dean of Student's office, a make-up exam can be given.
- Because exams are team-projects, if a student is not able to participate in a a teamproject on time, they will receive a comparable individual assignment as a make-up, which will be different from the team project.
- Late exams will not be accepted and will result in a score of 0 for the exam, and severe consequences for the letter grade.

## **Important Dates**

Date	Exam
March 7	Midterm Exam (Submission of the midterm report)
May 7	Final Exam (Submission of the final version of the report for the final project)
May 18	The final grades are due