ME 382: Experiments in Micro- and Nano Science and Engineering  
Department of Mechanical Engineering

**Class Hours:** TTh 2:00-3:20pm, Tech LG72  
**Laboratory Hours:** WF 2:00-6:00pm (see below for location)  
**Class Instructor:** Horacio Espinosa (Email: espinosa@northwestern.edu)  
**Lab Instructor:** Nasir Basit (Office: FG73, Phone: 7-6201, n-basit@northwestern.edu)

The objectives of this course are:
1. To provide clean room training and basic micro/nano fabrication skills  
2. To provide clean room operation and microfabrication equipment knowledge  
3. To build microfluidic components, with soft lithography, and image flows using fluorescent microscopy  
4. To provide training and experience in the utilization of scanning probe microscopy in a variety of modes  
5. To engage students in micro/nanotechnology research through a final project consisting of the design of a novel lab experiment.

**Course Schedule (Lab Projects):**

<table>
<thead>
<tr>
<th>Week #</th>
<th>Dates/Location</th>
<th>Lab Title</th>
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<tbody>
<tr>
<td>W1</td>
<td>(4/1)/Tech LG72, (4/3)/Tech LG72</td>
<td>Clean Room Safety &amp; Protocol Training</td>
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<tr>
<td>W2</td>
<td>(4/9, 4/11)/Tech FG74</td>
<td>Clean Room Tour and its Operation (safety glasses required for all labs)</td>
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<td>W3</td>
<td>(4/16, 4/18)/Tech FG74</td>
<td>Contact Aligner Operation &amp; Hands-on Practice</td>
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<td>W5</td>
<td>(4/30, 5/2)/Tech FG74</td>
<td>Design and Fabrication of Microchannels-PDMS molding</td>
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| W6*    | (5/8)/Tech LG72, (5/7, 5/9)/Tech FG74 | **Theory: microchannels and micro-PIV**  
Lab: Surface Properties and Fluid Transport in Microchannels- Contact angle measurement, flow data |
| W7     | (5/13, 5/15)/Tech LG72, (5/14, 5/16)/Tech FG74 | **Theory: micro-PIV**  
Lab: Surface Properties and Fluid Transport in Microchannels-Additional flow data acquisition/analysis |
| W8     | (5/23)/Tech LG72, (5/21, 5/23)/Cook 1146A | **Theory: AFM principles**  
Lab: AFM: Training & Hands-on Practice, tapping mode/fractal analysis |
Lab: AFM: Material Characterization |
| W10    | (6/3, 6/5)/Tech LG72 | Final Project Report and Presentations |

* Start working on final project.
**Grading:** Final course grade will be based on the following distribution.

- **Quizzes:** 20 %
- **Lab participation and reports:** 50 %
- **Final Project:** 30 %

**Submissions:** Reports submitted only in class.

**Late submission:** 20%/day deduction from the full score

**Recommended references:**


**Access to University Facilities:**

Most of the laboratory work will be done in NUFAB clean rooms.

**Final Project:**

Each group will propose to the instructor a final project consisting of the design of a lab complementary to the ones done in this class. Equipment needed for the lab should be restricted to that used in the labs or listed in www.nufab.northwestern.edu. A lab handout with the *same format* as the ones given in class should be written and submitted as final project report during the exam week.

**General Guidelines:**

- Each student will need to write and turn in his/her individual report. You are encouraged to work together and discuss lab problems but make sure that the work you turn in is your own.
- Late reports will be deducted at the rate of 20% per day late. Maximum grace period is until graded report is returned.
- Instructor reserves the right to raise the final grade of any student by one letter based on participation in class and laboratory sessions.
- Attendance to class and labs is required. If you cannot come please let the instructors know in advance. You should just send e-mail.
- Feel free to meet me in my office to discuss labs or other issues at any time. You may want to call before coming to see me to assure that I do not have a meeting coming up.