AIR SAMPLING AND ANALYSIS TECHNIQUES
11:375:424, 16:375:536
Instructor: Gedi Mainelis, Ph.D.
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Wed. 9:15 – 10:35 and 10:55 – 1:55
Cook Campus, Operator Training Center, Rooms 102 and 103

The class is a combination of lecture and laboratory exercises

IMPORTANT
Arrive on time and be prepared for laboratory exercises.
No texting or web browsing during the class.
You must wear shoes with closed toes.
You must wear safety glasses during all laboratory exercises.
Most course business will be conducted through the Rutgers SAKAI site.

COURSE DESCRIPTION

• The course provides scientific basis to understand the reasons, principles and techniques of air sampling as they are applied in our study of environmental and health effects of air pollution as well as in regulatory compliance.

• The course provides hands-on experience of various aspects of air sampling. Preparation and quality of written reports is emphasized.

LEARNING GOALS

The learning goals for the Environmental Science major are posted on our website at http://envsci.rutgers.edu/current_students/envsci_undergrad_program/learning_goals.shtml

This class will contribute toward the following goals:
1. Apply knowledge from the sciences and mathematics to environmental problems and solutions
2. Use the skills and modern environmental science techniques and tools necessary for a successful career in the field
3. Design and conduct experiments, and analyze and interpret data
4. Function effectively on multidisciplinary teams
5. Communicate technical information effectively (orally, in writing, and through electronic media)
**OUTLINE**

<table>
<thead>
<tr>
<th></th>
<th>Lecture:</th>
<th>Lab:</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to air sampling, basic gas laws, standards, calibration</td>
<td>Calibration of wet test meter (WTM) and dry test meter (DGM)</td>
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<td>2</td>
<td>Gas flow rate measuring devices;</td>
<td>Calibration of a limiting orifice</td>
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<td></td>
<td>Gas flow rate measuring devices; transport phenomena, Bernoulli’s theorem</td>
<td>“Velocity and flow measurement in a stack or duct” and “Calibration of an S-type pitot tube”</td>
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<tr>
<td>4</td>
<td>Gas flow rate measuring devices; transport phenomena, Bernoulli’s theorem</td>
<td>Calibration of a limiting orifice</td>
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<tr>
<td>5</td>
<td>Pitot tube; Volume measuring devices; pumps.</td>
<td>“Velocity and flow measurement in a stack or duct” and “Calibration of an S-type pitot tube”</td>
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<td>6</td>
<td>Continuation of volume measuring devices; pumps.</td>
<td>Bernoulli’s Theorem Demo using a Venturi Meter</td>
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<td>7</td>
<td>Exposure assessment, particle size distributions, aerosol properties</td>
<td>1. Calibration of a personal sampling pump; 2. Hand pump calibration</td>
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<td>8</td>
<td>Exposure assessment, particle size distributions, aerosol properties.</td>
<td>Use and comparison of different flow measurement techniques.</td>
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<td>9</td>
<td>SPRING BREAK</td>
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<td>10</td>
<td>“Biologically relevant measurements” and “Particle sampling and analysis techniques”</td>
<td>Collection of airborne particles and determination of their concentration.</td>
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<td>13</td>
<td>Principles of CO, Ozone, SO₂ and NOx analysis</td>
<td>Measurement of biological aerosols indoors and outdoors</td>
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<td>14</td>
<td>EPA source sampling methods; EPA Sampling train.</td>
<td>Gas measurement</td>
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<td>15</td>
<td>Review. Topics</td>
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<td>16</td>
<td>FINAL EXAM</td>
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**Literature:**

1. 11:375:424 and 16:375:536 Laboratory manual (provided on the class website) and handouts  
2. Lecture material and PowerPoint Presentations  
4. EPA, Air Pollution Training Institute, Course 435, “Atmospheric Sampling”.

Optional:
2. ”Aerosol technology” by W. Hinds, 1999.

Lab reports:
Due 1 week following the lab. Please follow the suggested format. Reports up to 1 week late will be discounted 10%. Reports more than 1 week late will be discounted 50%.
Submit the reports to SAKAI, or as email attachments to Dr. Mainelis mainelis@envsci.rutgers.edu and TA of the class (TBD).

The report file names should indicate your name and the lab number, i.e., “Smith-Lab2.doc” or “Smith-Lab2.docx”.

Grading:

<table>
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<tr>
<th>Undergraduate students</th>
<th>Graduate students</th>
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<tr>
<td>Laboratory Reports (70 %)</td>
<td>Laboratory Reports, including a set of additional calculations (70 %)</td>
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<tr>
<td>Final Exam (30 %)</td>
<td>Final Exam (30 %)</td>
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ASSESSMENT ACTIVITIES

1. Apply knowledge from the sciences and mathematics to environmental problems and solutions

Instructional Activity
Students will be instructed how to measure the presence of airborne particulate matter in indoor and outdoor environments.
Students will be instructed how to measures the presence of biological aerosols in indoor and outdoor environments.

Assessment Activity
Student reports detailing the process, results and interpretation of measuring the concentration of airborne particulate matter in indoors and outdoors (50% of assessment).
Student reports detailing the process, results and interpretation of measuring the presence of biological aerosols indoors and outdoors (50% of assessment).

2. Use the skills and modern environmental science techniques and tools necessary for a successful career in the field

Instructional Activity
Measurement and calculation of pollutant penetration/losses through sampling lines.

Assessment Activity
Student reports detailing the process, results and interpretation of pollutant penetration/losses through sampling lines (100% of assessment).
3. Design and conduct experiments, and analyze and interpret data

   **Instructional Activity**
   Data accuracy and uncertainty will be discussed
   Concepts of sampling train calibration will be discussed

   **Assessment Activity**
   Describe and calculate data uncertainty in a lab report (50% of assessment).
   Calibrate impinger sampling train using a vacuum gage and describe it in a lab report (50% of assessment).

4. Function effectively on multidisciplinary teams

   **Instructional Activity**
   Students will work in teams of 3-4 to conduct laboratory exercises.

   **Assessment Activity**
   Students function in teams to perform exercises and collect data. Instructor assesses how they function in teams (100% of assessment)

5. Communicate technical information effectively (orally, in writing, and through electronic media)

   **Instructional Activity**
   Students will write lab reports that report and interpret the data gathered during the laboratory exercises. Reports will use the scientific structure (Abstract, Introduction, Methods, Results, Discussion, References).
   Description and discussion of various air sampling techniques

   **Assessment Activity**
   Students will communicate data and their interpretation in three specific laboratory reports (50% of assessment).
   Students will answer specific technical questions in final exam (50% of assessment).