I. Course Description

This course explores the physical nature of gaseous and particulate air contaminants, their occurrence in workplaces, the factors governing generation and dispersal, the criteria, rationales and standards under which practical measurement in the workplace is conducted, the principles underlying industrial hygiene measurement techniques; processes of inhalation and deposition of aerosols and their ultimate fate, and scenarios linking exposure with aerosol-related ill-health.

II. Course Prerequisites

Students are expected to have a good grasp of elementary physics, chemistry, and mathematics, including calculus.

III. Course Goals and Objectives

Upon completion of the course, the students should be able to:

1. Understand the physical nature of both particulate and gaseous airborne contaminants and be able to express these properties quantitatively as well as qualitatively.

2. Understand the factors governing generation and dispersal, and relate such knowledge to the nature and magnitude of the exposures of people to such contaminants.

3. Understand the criteria, rationales and standards under which practical measurement in the workplace is conducted.

4. Understand the sources and nature of variability in worker exposure data.
5. Use the knowledge of the statistical distributions of worker exposures to properly design exposure assessment programs
6. Understand the principles underlying industrial hygiene measurement techniques and relate it to the assessment of human inhalation exposures.
7. Understand the processes of inhalation and deposition of aerosols and their ultimate fate, and scenarios linking exposure with aerosol-related ill-health.
8. Critically evaluate measurement studies in current scientific literature, and produce a written report that evaluates the quality of a journal article.

IV. Methods of Instruction and Work Expectations
The course is comprised of lectures, examples, and group discussions.

V. Course Text and Readings


VI. Course Outline/Weekly Schedule

**Week 1**
- Introduction to the course
- Properties of gases
- Elementary fluid mechanics

**Week 2**
- Uncertainties in physical measurements, calibration, random and systematic errors, propagation of errors, quantifying uncertainty, elementary statistics, the normal distribution.
- Air sampling systems;
  - Sampling heads, filters, pumps; flow measurement, primary and secondary standards, calibration.

**Week 3**
- Gas and vapor sampling systems
  - Sampling strategies: Active vs. passive; short-term vs. long term, area vs. personal.
  - Absorption, adsorption, collection media; Detector tubes; Concept of “breakthrough”;
  - Diffusion badges.
- Analytical methods for gases and vapors: Gas Chromatography; elementary principles; Mass spectrometry, Practical applications in industrial hygiene

**Week 4**
- [Self Study: Direct reading instrumentation for gases and vapors. Instruments based on absorption and emission of radiation, electrochemical properties, and thermal properties.]
- Basic aerosol properties.
- Elementary size statistics; particle size distributions; Hatch-Choate equation.
Week 5
- The motion of airborne particles.
- Equations of particle motion, particle aerodynamic diameter; elutriators; inertial impaction; cascade impactors; diffusion

Week 6
- Inhalation and respiratory deposition.
- Sampling of aerosols

Week 7
- Direct reading instrumentation for aerosols.
- The optical properties of aerosols.

VII. Evaluation and Grading
Student performance is based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework assignments</td>
<td>50%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50%</td>
</tr>
</tbody>
</table>

A set of homework problems based on the lectures and classroom discussions will be assigned every week and will be due the next class. These problem sets will contain both quantitative as well as essay-type questions. Students can work together on these problem sets and seek help from the instructor.

The final exam will be a take-home exam that will be given to the students during the last week of classes. They will be due one week later. The exam will be based on real-life problems and situations requiring use of the knowledge gained in the course. The exam will comprise both quantitative problems and discussions of measurement issues.

Extra credit work will not be accepted to improve the final grade. Assignment of final letter grades for the course will be based on the following guidelines:

A Outstanding achievement relative to course expectations (approx. 90-100%)
A-
B+ Achievement above course expectations (approx. 80-90%)
B-
C+ Achievement meeting the minimum course expectations (approx. 70-80%)
C-
D+ Achievement below minimum course expectations but sufficient to be awarded credit (approx 60-70%)
D No credit awarded (approx. below 60%)

Incomplete Grade
An incomplete grade is permitted only in cases of exceptional circumstances and following consultation with the instructor. In such cases an “I” grade will require a specific written agreement between the instructor and the student specifying the time and manner in which the student will complete the course requirements. Extension for completion of the work will not exceed one year.

**University of Minnesota Uniform Grading and Transcript Policy**
A link to the policy can be found at onestop.umn.edu.

**Incomplete Contracts**
An instructor can assign a grade of incomplete, “I,” when, due to extraordinary circumstances the student was prevented from completing the work of the course on time. The assignment of an “I” requires that a contract be initiated and completed by the student before the last day of class, and signed by both the student and the instructor. For more information and to initiate an incomplete contract, student should go to www.sph.umn.edu/grades.

**University of Minnesota Uniform Grading and Transcript Policy**
A link to the policy can be found at onestop.umn.edu.

**VIII. Other Course Information and Policies**

**Grade Option Change (if applicable)**
For full-semester courses, students may change their grad option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester) can be found at onestop.umn.edu.

**Course Withdrawal**
Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw.

Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Student Services Center at sph-ssc@umn.edu for further information.

**Student Conduct, Scholastic Dishonesty and Sexual Harassment Policies**
Students are responsible for knowing the University of Minnesota, Board of Regents’ policy on Student Conduct and Sexual Harassment found at www.umn.edu/regents/polindex.html.

Students are responsible for maintaining scholastic honesty in their work at all times. Students engaged in scholastic dishonesty will be penalized, and offenses will be reported to the Office of Student Academic Integrity (OSAI, www.osai.umn.edu).

The University’s Student Conduct Code defines scholastic dishonesty as “plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis.”

Plagiarism is an important element of this policy. It is defined as the presentation of another's writing or ideas as your own. Serious, intentional plagiarism will result in a grade of "F" or "N" for the entire course. For more information on this policy and for a helpful discussion of preventing plagiarism, please consult University policies and procedures regarding academic integrity: http://writing.umn.edu/tww/plagiarism/.

Students are urged to be careful that they properly attribute and cite others' work in their own writing. For guidelines for correctly citing sources, go to http://tutorial.lib.umn.edu/ and click on “Citing Sources”.

In addition, original work is expected in this course. It is unacceptable to hand in assignments for this course for which you receive credit in another course unless by prior agreement with the instructor. Building on a line of work begun in another course or leading to a thesis, dissertation, or final project is acceptable.

If you have any questions, consult the instructor.

**Disability Statement**
It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have a documented disability (e.g., physical, learning, psychiatric, vision, hearing, or systemic) that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact Disability Services to have a confidential discussion of their individual needs for accommodations. Disability Services is located in Suite 180 McNamara Alumni Center, 200 Oak Street. Staff can be reached by calling 612/626-1333 (voice or TTY).