Division of Environmental and Occupational Hygiene

Course Goals and Outcomes Form

Course number and title: 26-EIH-743  Physical and Biological Aspects of Aerosols
Graduate Credits: 3
Instructor(s) in-charge: Sergey A. Grinshpun, PhD
Course type (underline all that apply): Lecture  Laboratory  Field Projects
Required or Elective:

Course Schedule:
- Lecture: ___3__ hours per week  ___2__ meetings
- Discussion: _____ hours per week  _____ sessions
- _____ hours for informal discussion
- Field Work: _____ hours per week  _____ hours per survey/project
- Outside Study: ___6__ hours per week
- Office Hours: __as needed___________

Course Assignments:
- Homework: __4___ assignments
- Exams:  __2___ midterms / finals
- Reports:  _____ required
- Project  _____ required

Grading Policy:
Grade is calculated as follows: midterm- 50%, final – 50%.  Homework assignments are mandatory but the grades for homeworks do not contribute to the final grade. The grades for the midterm and final exam are determined based on the number of points: 51/60 or greater is A, 41/60 to 50/60 is B, 31/60 to 40/60 is C.  These thresholds may be adjusted based on the group performance curve.

Course Prerequisites:
Bachelor level background in Engineering/Science

Catalog Description:
Concepts and parameters for generating sampling, and characterizing airborne particles; statistical methodology; calibration and evaluation of particulate samples; discussion of direct reading instruments, additional information on biological aerosols and ambient air pollution.

Textbook and Any Related Course Materials:
Detailed handouts are prepared and distributed (average = 15 pages per lecture); three text books are recommended to choose from:

Blackboard:
None; students are required to provide email addresses and telephone numbers for contact purposes
Topics Covered:
1. Introduction. Basics of Gas Behavior. Major Definitions and Mechanisms (1.5 hrs.)
2. Particle Motion in Air: Gravitational Settling, Inertia. Diffusion. Electrostatic Behavior of Aerosols (3 hrs)
3. Concept of the Aerosol Particle Size Distributions. Size Characterization. (1.5 hrs)
4. Aerosol Generation and Dispersion (1.5 hrs)
5. Aerosol Sampling and Collection: Basic Principles . Instruments (Filter Cassettes, Single-Stage and Cascade Impactors, Liquid Impingers and Cyclones) (3 hrs)
6. Principles of Real-Time Aerosol Measurement (1.5 hrs)
7. Aerosol Behavior in the Respiratory Tract & Health-Related Sampling Standards. Occupational Aerosols. (1.5 hrs)
8. Ambient Aerosols. PM10 and PM2.5. Indoor/Outdoor Ratio. Examples of a Large-Scale Aerosol Exposure Monitoring Studies (1.5 hrs)
9. Air Purification (1.5 hrs)
11. Overall review (1.5 hrs)

Course Goals (and Program Outcomes):
1. Demonstrate an understanding of the fundamentals of aerosol behavior and transport as well as basic approaches to generating, sampling and characterizing airborne particles and microorganisms. (A1, B1, B2)
2. Understand the operational principles of stationary and personal aerosol measurement instruments, including PM collectors and direct-reading devices. (D2, D3)
3. Relate the aerosol monitoring data to the human exposure and health effects in occupational and residential indoor environments as well as in ambient air environments. (C1, C2, D3, D5, E1, H1, H2, J2)

Evaluation Criteria:
Students are evaluated based on one midterm examination and one final examination. In addition, students are given homework assignments (completion is mandatory but the grades for homeworks do not contribute to the final grade).

NOTE: The ABET Program outcome is shown as a capital letter; the number designates the program specific outcome.

Relation to Program Educational Objectives:
This is a required course for all Comprehensive Practice majors. The course contributes to the following Program Educational Objectives, as shown:

- **Fundamental Knowledge**
  - Hygiene Science 35%; Basic Science 30%
- **Design Skills**
  - Design Skills 15%
- **Professional Skills**
  - Professional Skills 10%
- **Life-long Learning**
  - Life-long Learning 10%

NOTE: EOH faculty define Hygiene Science as all the Knowledge Elements other than the Basic Sciences; Design skills are those necessary to solve real world problems. Professional skills are those that involve teams, management, leadership, written and oral communication, approach to stakeholders and ethics; life-long learning is demonstration of the need for continuing professional development.

Is there a TA? Yes No
Is computer use expected? Yes No

Program outcomes and how they are covered in this course
For each ABET IH Program Outcome (A through L), the EOH Educational Outcomes are shown below. Upon completion of this course, students will have had the opportunity to acquire knowledge (K), skills (S) and attitudes (A) associated with each of the Educational Outcomes, as noted by underlining. Where the educational measurable outcome contributes strongly to the ABET Program Outcome, the K/S/A is shown in upper case;
where the contribution is average, the k/s/a is shown in lower case letters. (Note, use the Contribution to Knowledge and Professional Skills estimates above to guide your decision.)

A. Identify agents, factors and stressors generated by and/or associated with defined sources, unit operations and/or processes:
   - Identify potential health hazards of workplace processes and operations

B. Describe qualitative and quantitative aspects of generation of agents, factors and stressors:
   - Describe the underlying processes of the generation of hazards in occupational and environmental settings
   - Describe qualitative and quantitative aspects of hazards associated with specific occupational or environmental sources

C. Understand physiological and/or toxicological interactions of physical, chemical, biological and ergonomic agents, factors and/or stressors with the human body:
   - Understand the relation between exposures and health outcomes
   - Compare and contrast the potential for differences in response to hazards due to personal factors among some subjects at risk of exposure and the subsequent need to modify programs and practices

D. Assess qualitative and quantitative aspects of exposure assessment, dose-response, and risk characterization based on applicable pathways and modes of entry:
   - Describe how to evaluate potential adverse outcomes of chemical or physical exposures, based on similarity of the exposure to documented hazards
   - Describe occupational hygiene aspects of emerging technologies
   - Describe the basic principles of conducting sampling and analysis for exposure assessment
   - Describe the basic principles of evaluating engineering and non-engineering controls to reduce exposure
   - Develop and implement an exposure assessment plan to evaluate potential hazards and existing controls
   - Gather, manage and analyze quantitative (e.g., measurements of exposure or system performance) and qualitative (e.g., written programs) data to evaluate potential hazards and existing controls in order to reduce risk

E. Calculate, interpret and apply statistical and epidemiological data:
   - Apply epidemiologic and/or statistical concepts to the interpretation of exposure data

F. Recommend and evaluate engineering, administrative and personal protective equipment controls and/or other interventions to reduce or eliminate hazards:
Identify and recommend appropriate methods to reduce exposure (using engineering controls, personal protective equipment or administrative controls), or deficiencies in written programs and policies

Design work process/practice interventions

G. Demonstrate an understanding of applicable business and managerial practices:

Produce accurate oral and written reports, including descriptions of occupational processes and activities, exposure assessment plans and evaluation of occupational and environmental work settings

Describe approaches to interact with higher-level decision makers in various management structures

Manage resources effectively

Display effective leadership

H. Interpret and apply applicable occupational and environmental regulations:

Understand, interpret and apply occupational and environmental regulations

Apply guidelines, standards and laws in interpreting qualitative and quantitative data for exposure assessment for risk characterization

I. Understand fundamental aspects of safety and environmental health

Apply the professional code of ethics to a scenario

J. Attain recognized professional certification

Explain the importance of ethics in the practice of occupational and environmental hygiene

Understand the need for and resources available for continuing professional development after graduation

Describe the requirements to obtain professional certification

K. Conduct a research activity resulting in a report that demonstrates mastery of the subject and high level of professional and public communication skills

Design a research question, develop a plan and conduct research

Communicate effectively with a variety of stakeholders (e.g., labor, management, government, peers, safety and health professionals, allied professionals)

Produce a technical scientific report on research

L. Demonstrate advanced qualitative and quantitative problem-solving skills
Function effectively as part of a multidisciplinary team to investigate and propose a solution to an exposure hazard in a workplace.

COURSE MATERIAL AND AVAILABILITY

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<thead>
<tr>
<th>Course Goals/outcomes</th>
<th>Students</th>
<th>Instructor(s)</th>
<th>TA</th>
<th>Division</th>
<th>Department</th>
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</thead>
<tbody>
<tr>
<td>Lecture notes, assignments</td>
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<td>Samples of homework and correct answers</td>
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<td>Samples of reports, graded</td>
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<td>Course evaluation from students</td>
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<td>Instructor response/actions to evaluation comments</td>
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NOTE: Students provide feedback on individual courses through the end-of-class Department and Division evaluation survey instrument. This instrument provides feedback on the course material, organization and presentation, and perceived contribution of the course to the achievement of Program Outcomes. In addition, feedback is received from the continuing, semi-annual Question-feedback process during which students identify Best Learning Experience, Session/presentation that was an endurance test, What would make life as a student better?, If I could do it over, I would…, Opportunities I would like to have but don't seem to be available, Opportunities I would like more of, Aspects of the program the faculty should consider eliminating, Worst part of the UC program, Best part of the UC program, Other comments. A Ph.D. and M.S. student participate in Division faculty meetings. Exit surveys are conducted by the University and the Division as part of the requirements for graduation. All students are urged to participate fully in each of these activities in order to improve the educational experience.