# IH&S 528: Industrial Ventilation Design

7/29/14

**Course:** IH&S 528- Industrial Ventilation Design

**Semester:** Fall 2014

**Number of credit hours:** 3

**Description:** Course focuses on the design of industrial exhaust ventilation for contaminant control. Includes "indoor air quality," dilution ventilation, hood design, duct system design, selection of fans and air-cleaning devices, and measurement of pressures and flows in systems.

**Prerequisite:** Senior or graduate student standing


## Instructor

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|---|---|
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**Textbook:**

The primary reading material is chapters I wrote. Most are posted as pdf files on eCampus. The rest are chapters in ACGIH's Industrial Ventilation- a manual of recommended practice. I have a couple of copies of the latter. Studies are encouraged to supplement their reading from other texts, journals (e.g., JOEH) and from materials found online.

**Course goals and learning objectives:**

Students will be taught the concepts and design practices of exhaust ventilation design, including dilution ventilation, hood design, duct design, pressure calculations, fan selection, and air-cleaning device selection. Also includes instruction and hands on experience in measuring air velocities and pressures. Upon completion of the course, diligent students should know how to design a ventilation system for contaminant control.

The key abilities to be acquired by the students as addressed in this outcome are as below.

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

- Design hoods for contaminant control
- Design duct systems
- Select an appropriate fan for a system
- Measure ventilation pressures and velocities

**IH Educational Outcomes**: This course helps achieve the Educational Outcomes for the MS Industrial Hygiene Program in the following areas:

1. The ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice, such as:

   f.) Principles and methods of control of physical and chemical hazards, in this case, ventilation design of hoods and duct systems and selection ventilation system components, such as fans.
2. The ability to work individually, on teams, and/or on multi-disciplinary teams to identify, formulate and solve problems using Industrial Hygiene, safety, and ergonomics knowledge, skills and tools.
3. An ability to formulate or design a system, process or program to meet desired needs.

**Course Contribution to Professional Component:**

Engineering Science - 50 %, Engineering Design - 50 %

**Performance Metrics:**

1. Faculty assessment of home works, projects, and exams.
2. Student self-assessment.

**Method of Instruction**

Includes 3 hours of lectures each week of the semester, except for class times set aside for exams, pop tests, laboratories, and review of homework. Includes at least one laboratory exercise.

**Grading Elements, Weighting:**

| Grade Element | Weighting |
|---|---|
| Midterm | 35% |
| Final | 35% |
| Homework | 15% |
| Laboratories and reports | 15% |

Grades

| Letter Grade | A | B | C | D | F |
|---|---|---|---|---|---|
| Numerical grade | ≥ 90 | 80-89 | 70-79 | 60-69 | < 60 |

# Agenda

**Topic 1: Introduction to Ventilation Design**

**Topic 2: Introduction to Fluid Mechanics**

**Topic 3: Dilution ventilation**

**Topic 4: Hood Design**

**Topic 5: Make-Up Air**

**Topic 6: Measurement of pressures and flows**

**Topic 7: Exhaust System Design, Simple Systems**

**Topic 8: Construction Specifications**

**Topic 9: Fans**

**Topic 10: Exhaust System Design, Multiple–Branch Systems**

**Topics 11: IAQ**

**Topics 12: Non-Ionizing Radiation**

**Lecture 13: Air-Cleaners and Their Selection (if time)**

**Lecture 14: Review (if time)**

# Labs and Exercises

Ventilation design is a practical and marketable skill -- if you have confidence in your ability to take accurate measurements and to develop solutions that are likely to work. The labs and exercises are intended to develop a deeper understanding and facility with the subject of the lab.

For each exercise, students will collect the data as groups, but each student will write their own report. Data is shared within the group, but not wording or organization of the report. Each student must complete their own report without help from anyone other than the instructor.

Each report must be written as if to the manager of a manufacturing facility, including a cover letter. Reports are graded on:

1) technical accuracy and completeness,
2) clear organization and presentation
3) readability, including succinctness and appropriateness of wording for the intended readers,
4) appropriate tone and style.

The report should be fairly simple. Tell your objective, the apparatus, the methods, show your results (put a few sample calculations and your spreadsheet in the appendices), discuss them and come to some conclusions.

You results should include a table comparing measured values against expected values.

# Spreadsheets and other HW

It is highly recommended that you become proficient in use of spreadsheet programs. Indeed, you should work all example problems in the text using spreadsheets you have constructed. You may use the same spreadsheets for take-home exams, if you wish. You can have general help on constructing spreadsheets, but you may not use any spreadsheet largely developed by others or "proofed" by others on a take-home exam (if one is given). Do your own and use your own.

Be sure to document spreadsheets to show your work. Be sure that what you have presented is easy to follow and follows good practices, such as:

(1) it is clearly and concisely written or documented
(2) if printed, your name appears at the top right of every printed page, the assignment description is shown on the top middle of each page, and the page number is shown on the bottom middle of each page.
(3) if printed, it should not be necessary to tape two pages together to see what you have done.

(4) If you are filling in tables I have created, be sure to use blue fonts for the parts you do.
(5) The filename includes your name, the assignment, and the last date you worked on it (e.g., pressure calcs, SEG, 13 Aug '14.xlx).

# West Virginia University Policies

**Academic Dishonesty**

Acts of academic dishonesty, such as cheating or plagiarism or assisting others in cheating, will result in a failing grade (F) and will be reported to the department Chair.

Collaboration between students: seeking help from other students is encouraged for homework and example problem sets. The exceptions are take-home exams (if any) or assignments where I specifically say that no collaboration is allowed.

**Statement on Social Justice**

West Virginia University is committed to social justice. I concur with that commitment. I expect to foster a nurturing learning environment that is based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

**Statement on Disability Accommodation**

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, you must make appropriate arrangements through Disability Services (293-6700). They will identify the nature of the accommodation your disability requires and inform me of appropriate accommodations.

**Statement on Attendance**

If a student is absent without an acceptable excuse on the day of a test or exam, the student will receive a zero on that test or exam.

Prepared: August 2014