

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
SCHOOL OF ENGINEERING
DEPARTAMENT OF CHEMICAL ENGINEERING AND BIOPROCESSES
ABET COURSE SYLLABI

IIQ2343 AIR POLLUTION ENGINEERING

Credits and contact hours: 10 UC credits /10 hours (3 h. Lectures; 1,5 h. Assistantship; 5,5 h. Independent learning experiences)

Instructor's name: Héctor Jorquera

Course coordinator's name To be defined

Textbook: Lecture notes and handouts provided by the instructor.

Course Catalog Description: Air pollution is caused by the persistent release into the atmosphere of chemicals, particulate matter and energy in such amount that harms people, ecosystems and built environment, interferes with climate and people's wellbeing.

These problems evolve at different spatial and temporal scales: local (odor nuisance, industrial emissions, agriculture burn practices), urban (traffic, noise, ozone), regional (ozone, PM_{2.5}, visibility, acid rain), and global (greenhouse gases, persistent organics, ozone depleting chemicals).

This course is focused in the quantitative analysis of different parts of the problem such as ambient concentrations, health effects, limiting factors (meteorology, emissions) and how to design industrial scale solutions (abatement of PM, gases and VOC emissions).

Prerequisite Courses: ICH1104 Fluid Mechanics + IIQ1003 Thermodynamics (or equivalent)

Co-requisite Courses: None

Status in the Curriculum: Required

Course Learning By the end of this course, student will be able to:

Outcomes:

1. Diagnose air quality and trends for a given urban site.
2. Estimate health impacts of air pollution.
3. Describe several features of atmospheric particles in a quantitative manner.
4. Measure ambient particles and interpret the results
5. Analyze dispersion of air pollutants.
6. Use computer dispersion models to estimate impacts and spatial distribution of air pollution.
7. Select and size equipment for air pollution emission abatement.

**Relation of Course to ABET
Criteria:**

- a. Knowledge of mathematics, science and engineering
- b. Design and conduct experiments: analyze and interpret data
- c. Design a system, component, or process
- e. Identify, formulate, and solve engineering problems
- g. Effective communication
- h. Broad education necessary for global, economic, environmental and societal context
- k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

0. Introduction. A sequential cause-effect link: from source to receptor. Regulated air pollutants. Urban, regional and global scale problems. Air quality at local, regional and global scale. Who are subject to greater risks?
1. Methodology. Sequential risk analysis: human activities, emission inventories, air quality monitoring, air quality modeling, health impact models, and economic models. Use of computer tools to carry out quantitative analyses.
2. Air pollution health effects. Health damaging pollutants. Basic epidemiological concepts. Quantitative modeling of health endpoints and its association to air pollution. Short and long term effects.
3. Particulate Matter. Size distribution. Origins and chemical speciation. Main primary sources. Secondary aerosol generation. Atmospheric processing of aerosols. Simple relationship between emissions and air quality.
4. Meteorology. Global wind circulation. Force balance and wind regimes. Atmospheric stability and mixing height. Routine processing of surface measurements. Use of thermodynamic diagrams to analyze vertical profiles of wind and temperature.
5. Air pollution dispersion. Mass conservation under turbulent conditions, eddy diffusivity coefficients. Gaussian plume approximation. Available models. Applications to assessment of air quality impacts.
6. Particulate matter control equipment: selection and sizing of equipment.
7. Control of gases, VOC and odors: selection and sizing of equipment.
8. Laboratory practice: measurement of ambient particle size distribution at different campus location (includes group report).
9. Group term project: air pollution dispersion using US EPA's AERMOD (includes group report).

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