**Integrated Air Quality Management**

**Fall semester, 2019-2020**

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| Coordinator | **Nghiem Trung Dung** |
| Credits | 3 ECTS (optional course), 45 in-class hours |
| Lecturers | **Nghiem Trung Dung** (Hanoi University of Science and Technology, Vietnam)  **Ly Bich Thuy** (Hanoi University of Science and Technology, Vietnam) |
| Level | Ph.D |
| Host institution | **Hanoi University of Science and Technology**, School of Environmental Science and Technology |
| Course duration | October 19 – November 23, 2019 |

### Summary

*This 3 ECTS course serves as an advance to air quality management. It provides doctoral students with advanced knowledge on air quality management so they can meet the increasing requirements in the fields of environmental engineering as well as natural resources and* *environmental management. The main content of the course includes air pollution monitoring; air quality modelling; air pollution control techniques; different tools used for air quality management; frameworks for the integrated air quality management in selected sectors including transportation and industry, sustainable transportation.*

*Through the course, students will also be enhanced with analytical, synthesis, presentation and teamwork skills.*

### Target student audiences

Doctoral students in the fields of:

* Environmental engineering
* Environmental science
* Natural resources and environmental management
* Heat engineering
* Transportation engineering

### Prerequisites

Required courses (or equivalents):

* Environmental engineering and/or science
* Natural resources and environmental management
* Heat engineering
* Transportation engineering

### Aims and objectives

The main course objective is to provide students with integrated approach in air quality management (AQM). Cause-effect link from emission to health risks is considered. Key pollutants and key sources are firstly focused. Cost effectiveness of actions for AQM are also considered. Policy and technical issues are integrated. Air quality data are disseminated and awareness are raised to build political support for AQM.

To address the strategies of integrated AQM and guide how to develop a Clean Air ImplementationPlan (CAIP). Dedicated air quality legislation, involving all stakeholders, and strengthening the use of economic instruments are extended. Transport demand management and transport planning are emphasized. The use of tools for AQM and air pollution information for land use planning (e.g. zoning) is increased. Air quality and emissions standards are tightened with a suitable roadmap. Political and public awareness of the health and environmental impacts of air pollution and their costs is increased. More public health and environmental studies are promoted.

Different stakeholders/actors including Government, Markets and Community are addressed to get involved for AQM. DPSIR model for decision making is used. Different tools including legislative, technical and economic ones are applied in an integrated manner. Opportunities and challenges in AQM for developing countries are analyzed. AQM frameworks for industry and road traffic sources are provided.

### General learning outcomes:

Upon completion of the course, PhD students are to:

* understand the integrated approach in air quality management.
* understand cause-effect link from emission to health risks
* be able to identify key pollutants and key sources in specific cases
* be aware of economic aspects of actions for AQM.
* be aware of the strategies of integrated air quality management
* understand the steps to develop a Clean Air ImplementationPlan (CAIP).
* be aware of different stakeholders/actors need to get involved for AQM.
* be aware of DPSIR model for decision making
* be able to apply different tools for AQM in an integrated manner.
* be aware of opportunities and challenges in AQM for developing countries
* be able to apply AQM frameworks for industry and road traffic sources.
* be aware of sustainable transportation

### Overview of sessions and teaching methods

The course will try to make use of interactive and self-reflective methods of teaching and learning including video show, video conference (if possible), course assignment/project and their presentations and discussions. It will start with an introduction to technical tools for AQM including air quality and emission monitoring, air quality modelling. Legislative and economical tools for AQM are addressed in this part. The second part will provide with different techniques for air pollution control for stationary and mobile sources. The third and also main part will focus on integrated air quality management: the strategies of integrated AQM and how to develop a Clean Air ImplementationPlan (CAIP), different stakeholders/actors for AQM, DPSIR model for decision making in AQM, opportunities and challenges in AQM for developing countries, AQM frameworks for industry and road vehicles sources, sustainable transportation.

### Course workload

The table below summarizes course workload distribution:

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| --- | --- | --- | --- |
| **Activities** | **Learning outcomes** | **Assessment** | **Estimated workload (hours)** |
| **In-class activities** | | | |
| Lectures | Understanding theories, concepts, methodology. | Class participation | 35 |
| Moderated in-class discussions | Understanding various techniques, tools and management contexts and common problems in air quality management. | Class participation and preparedness for discussions | 5 |
| In-class assignments | Understanding various techniques, tools and management contexts and common problems in air quality management. | Class participation and preparedness for assignments | 5 |
| **Independent work** | | | |
| Group work:   * Contribution to the group case-study projects * Contribution to the preparation and delivery of individual presentation | Ability to use the concepts, tools, and methods for IAQM  Plan and develop a Clean Air ImplementationPlan. | Quality of group assignments and individual presentations | 45 |
| Course group assignment | Ability to deal with real cases of IAQM | Quality of developed IAQM strategies and their presentation | 45 |
| ***Total*** |  |  | ***135*** |

### Grading

The students’ performance will be based on the following:

* Process assessment: 40% including:
  + Level of preparedness for participation in class discussions and seminars (10 %) (from 100 % for active participation and demonstrated familiarity with the course readings to 0 % for completely ignoring in-class discussions);
  + Group assignments (15 %) (from 100% for clearly demonstrated input to 0 % for non-participation);
  + Mid-term exam (15%)
* Final exam: 60%

### Course schedule

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| **Day**  **(Tentative)** | **Time** | **Topic** | **Lecturer** |
| October 19, Saturday | 08:00-09:30 | Air quality monitoring (PM) | Nghiem Trung Dung |
| 09:45-11:15 | Air quality monitoring (Gaseous pollutants) | Nghiem Trung Dung |
| 11:30-12:15 | Air emission monitoring (PM) | Nghiem Trung Dung |
| October 26, Saturday | 08:00-09:30 | Air emission monitoring (Gaseous pollutants) | Nghiem Trung Dung |
| 09:45-11:15 | Air quality modelling (Dispersion modelling) | Nghiem Trung Dung, Ly Bich Thuy |
| 11:30-12:15 | Air quality modelling (Receptor modelling) | Nghiem Trung Dung |
| November 2, Saturday | 08:00-09:30 | Legislative and economic tools for AQM | Nghiem Trung Dung |
| 09:45-11:15 | Techniques for air pollution control of stationary sources | Nghiem Trung Dung |
| 11:30-12:15 | Techniques for air pollution control of stationary sources | Nghiem Trung Dung |
| November 9, Saturday | 08:00-09:30 | Techniques for air pollution control of mobile sources | Nghiem Trung Dung |
| 09:45-11:15 | Techniques for air pollution control of mobile sources | Nghiem Trung Dung |
| 11:30-12:15 | Integrated approach in air quality management | Nghiem Trung Dung |
| November 16, Saturday | 08:00-09:30 | The strategies of integrated AQM | Nghiem Trung Dung |
| 09:45-11:15 | Development of a Clean Air ImplementationPlan. | Nghiem Trung Dung |
| 11:30-12:15 | Stakeholders/actors for AQM. | Nghiem Trung Dung |
| November 23, Saturday | 08:00-09:30 | DPSIR model for decision making.  Opportunities and challenges in AQM for developing countries | Nghiem Trung Dung |
| 09:45-11:15 | Development of AQM strategies for industry and road vehicles | Nghiem Trung Dung |
| 11:30-12:15 | Sustainable Transportation | Nghiem Trung Dung |

### Course assignments

Course assignments will constitute a multi-part project:

* Assignment #1 (mostly in-class) – General strategies IAQM strategies in developing countries
* Assignment #2 – Development of an IAQM strategies for Thermal Power Plants.
* Assignment #3 – Development of an IAQM strategies for road vehicles in cities.

To complete the assignments, the class will be divided into several groups (if possible).

**Assignment #1** will help students to understand the general content of the course. The outcomes of the first assignment are proposals for AQM strategies for specific cases (ppts and oral presentations).

**Assignment #2** will require a greater level of dealing with real work from students. Partly based on Assignment #1, it requires students to develop an IAQM strategies (framework) for Thermal Power Plants, a main air pollution source.

**Assignment #3** will also require a greater level of dealing with real work from students. Partly based on Assignment #1, it requires students to develop an IAQM strategies (framework) for road vehicles, a main air pollution source in cities.

**Literature**

Nguyen Thi Kim Oanh (Edited). *Integrated Air Quality Management – Asian case studies.* CRC Press, Taylor & Francis Group, New York, USA, 2013.

David Cooper C. and Alley F. C. *Air pollution control.* 4th Edition. Waveland Press, Inc., Illinois, 2011.

Frank R. Burden, Dietfried Donnert, Thad Godish and Ian McKelvie. *Environmental Monitoring Handbook*. McGraw-Hill, 2004.

John H. Seinfeld and Spyros N. Pandis. *Atmospheric Chemistry and Physics*, Second Edition. John Wiley and Sons, 2006.

Kenneth Wark, Cevil F. Warner and Wayne T. Davis. *Air pollution* - *Its origin and control*. Addison Wesley Longman, Inc., 1998.

Noel de Nevers. *Air pollution control engineering.* 2nd Edition. Waveland Press, Inc., Illinois, 2010.

Ronald M. Heck, Robert J. Farrauto and Suresh T. Gulati. *Catalytic Air Pollution Control*. 3rd Edition, John Wiley & Sons, USA, 2009.

Yen-Lien T. Nguyen, Trung-Dung Nghiem, Anh-Tuan Le, Khanh Nguyen Duc, Duy-Hung Nguyen, 2021. Emission characterization and co-benefits of bus rapid transit: a case study in Hanoi, Vietnam. *Atmospheric Pollution Research*. Vol. 12, Issue 8, August 2021, 101148, <https://doi.org/10.1016/j.apr.2021.101148>.

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