Fall 2015

ENCE 5328

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University of New Orleans

ENCE 4328/5328 - AIR POLLUTION CONTROL (3 Cr Hrs)

Fall 2015

(Internet Class; But will also meet in class as appropriate)

(Office Hours: TBA)

Draft!

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ENCE 4328 Air Pollution Control (3 Cr. Hrs.)
Prerequisites: Departmental consent.
Air pollutants and their sources, air pollution meteorology, effect of air pollution on man, vegetation and materials, air quality standards, atmospheric sampling and analysis, dispersion of pollutants, technology of air pollution control, and combustion evaluation. Each student will work on a project in which the student has to adopt one industry and apply the knowledge gained in the course to develop an air quality management report.

ENCE 5328 Air Pollution Control (3 Cr. Hrs.)
Prerequisites: ENCE 3318 (Principles of Hydraulics) or ENME 3720 (Fluid Mechanics).
Air pollutants and their sources, air pollution meteorology, effect of air pollution on man, vegetation and materials, air quality standards, atmospheric sampling and analysis, dispersion of pollutants, technology of air pollution control, and combustion evaluation. Each student will work on a project in which the student has to adopt one industry and apply the knowledge gained in the course to develop an air quality management report. Graduate students enrolled in 5328 must carry out additional work to earn graduate credit.

I. Course Objective / List of Learning Objectives

The objective of this course is to give students a basic understanding of various aspects of air pollution. Main topics of the course include sources of air pollution, health effects, regulations, measurement techniques, meteorology, pollutant dispersion, and most commonly used control equipment. Students will learn basic design considerations for important control equipment and industrial stacks. This is an introductory course in air pollution subject. After successfully completing this course, students will be able to:

- Understand various air pollution sources, types of pollutants, their effects, air pollution measurement methods, and air quality regulations
- Understand the importance of process design in minimizing air pollution from industrial operations, air pollution control equipment costing, and economics as applied to air pollution control projects.
- Understand particulate behavior in air, characteristics, size distribution, and their removal processes from air streams.

- Understand popular particulate control devices, particulate removal mechanisms and be able to design aspects and cost estimates. These control devices include cyclones, electrostatic precipitators, and baghouses.

- Understand the control of gaseous pollutants and basics of adsorption and absorption principles.

- Understand the basics of air pollution meteorology and atmospheric dispersion and be able to use Gaussian Dispersion Model to estimate pollutant concentration in ambient air for point sources.

- Students will learn how to apply this theoretical knowledge to one adopted industry and will develop an air quality management report. Students will develop a written report and will make about two to three oral presentations about their work to the rest of the class.

II. Text Book

"Air Pollution Control - A Design Approach," Fourth Edition by C. David Cooper and F.C. Alley. Published by Waveland Press, Inc.

Additional reading material will be provided in the class. In addition, a list of outside reading required for this course will be suggested during the course instruction.

III. Course Pre-requisites:

ENCE 3318 (Principles of Hydraulics) or ENME 3720 (Fluid Mechanics).

IV. Office Hours for Consulting:

By prior appointment only. Please send an email to bkura@uno.edu to make an appointment.

V. Grading Criteria:

There will be one midterm exam and one final exam each worth 25% of the total grade. The midterm test dates will be discussed in the class. The final exam will be conducted according to UNO exam schedule.

There will be many quizzes (announced and unannounced) and homework assignments that carry a total weight of 20% toward the final grade. Class participation and attendance will be given 5% weight towards the final grade. For the balance 25% of the grade, each student has to work on a selected project. For this project, students have to work on one specific industry sector (such as steel, petroleum, aerospace etc.) to assess air pollution resulting from that industrial activity and also apply the knowledge acquired from the course work to develop an air quality management plan. Details of the project are described below:

Project on selected/assigned industrial sector to assess air pollution and design air quality management plan:

Each student has to conduct a literature survey on one air-pollution topic selected/assigned to him/her. Topics will be assigned right at the beginning of the course to give ample time to complete the project. The project report, air quality management report for the selected industrial sector, should be submitted (Hard copy and soft copy; Word format, 12 font size, Times Roman font type; Excel/Access for data tables; 11" x 8.5" size sheets). The literature survey should include a review of textbooks, government documents, journal articles, research notes, state / federal regulations, and other technical reports. The references used should be cited in the end. The report style should be similar to that of a journal article.

During the semester, students will present two to three times their project progress to the class. Approximately 10 minutes time will be allowed for each presentation. Students will earn 25% of their grade based on the work they do on the written project report and presentations. Additional project details will be provided in the class. Distribution of weight on different scores:

Mid Term Test	-	25% of the overall grade
Project	-	25% of the overall grade
Homework / Quizzes	-	20% of the overall grade
Participation	-	5% of the overall grade
Final Exam	-	25% of the overall grade
Total	-	100%

Students will earn their grades as follows:

91 and above	-	Grade A
81 - 90	-	Grade B
71 - 80	-	Grade C
61 - 70	-	Grade D
Less than 61	-	Grade F

VI. Tentative Class and Exam Schedule

Week 1 - Student and Teacher Introduction
Course outline and introduction to the course
Glossary of terms
Project assignments

Week 2 - Chapter 1 - An Overview
General, Types of Pollutants, Global Air Pollutants, Regulations.
Ideal Gas Law, Gas Flow Measurement, Causes, Source, Effects
PM, SO_2, NO_x, Photochemical Oxidants, VOCs
National Air Quality Standards, Problems.

Week 3 - Chapter 2 - Process Design
General Design Considerations, Engineering Economics
Cost of Control Equipments, Operating Costs of Control Equipment
Control Equipment Cost Estimation, Preliminary Fixed Capital Cost, Estimates for Pollution Control Projects, Annual Operating Cost Estimates, Problems.

Week 4 - **Project progress reports / Presentations / Discussions**
(Industrial processes, input materials, output materials, air pollutants)

Week 5 - Chapter 3 - Particulate Matter
Characteristics of Particulates
Particulate Behavior, Overview of Particulate Control, Problems.

Week 6 - Chapter 4 - Cyclones
Introduction, Sizes, Theory, Cyclone Efficiency, Design Considerations, Pressure Drop, Costs, Problems.

Week 7 - Chapter 5 - Electrostatic Precipitators
Introduction, Theory, Design Considerations, Corona, Particle Resistivity, Internal Structure, ESP Components, Removal of Particle Dust, Power Requirements, Flue Gas Conditioning, Problems.

Week 8 - **Mid Term Exam**

Week 9 - Chapter 6 - Fabric Filters
Introduction, Theory, Design Considerations, Types:
Reverse-Air, Shaker, and Pulse-Jet. Costs and Problems.

Week 10 - **Project progress reports / Presentations / Discussions**
(Estimating air pollutant quantities for various processes under variable conditions (uncontrolled emissions); control techniques; controlled emissions;

Week 11 - Chapter 18 - Air Pollution Meteorology
Introduction to Meteorology
Introduction, Atmospheric Circulation Patterns, Local Circulation Effects, Atmospheric Stability, Meteorology and Air Pollution, Stack Design, Problems.

Week 12 - Chapter 19 - Atmospheric Dispersion Modeling
Introduction, Meteorological Parameters, Wind Profiles, Temperature Profiles, Inversion, Stability Classes, Dispersion, the Gaussian Model, Stability Classes.

Averaging Times, Maximum Ground Level Concentration, Plume Rise, Models for Point, and Line Sources, Problems. An Overview of computer models and the data required. Demonstration of a computer model.

Week 13 - Introduction to Gas Adsorption and Gas Adsorption.

Week 14 - Introduction to Control of Sulfur Oxides and Nitrogen Oxides

Project reports due on this day. (Before THANKS GIVING HOLIDAY)

Week 15 - **Final presentations by students on their projects**
(Processes, process alternatives, materials, material alternatives, process conditions, variations in process conditions, air pollutants, regulations (federal, and state), applicable control equipment, controlled and uncontrolled emissions, reporting requirements (annual emission inventories to comply with air permits, Tier II reports, TRI reports, and other reports to comply with MACT/NESHAPs), case studies, etc.)

Week 16 - **Final Exam**

VII. Important Policies

Graduate Students Seeking Credit (Those registered for ENCE 5328):
Graduate students taking this course for credit are required to do additional work beyond the regular course work. This additional work includes identification of published technical paper relevant to their specific adopted-industry, review, analysis, and discussion. Details of the work have to be presented in the project report and a final oral presentation.

Departmental Policy on Grades:
It is the policy of the graduate faculty of the Civil and Environmental Engineering Program that a graduate student will be dropped from the Civil and Environmental Engineering graduate program if they make an "F" grade or two "D" grades in their course of study.

Also, the graduate students need a minimum of B in order to get a credit toward their graduate degree requirement.

Attendance Policy:
Class attendance is in accordance with the published university policy. Regular attendance is required in this course. You must sign in on a sign-on sheet passed around during the class. You are responsible for material identified in the Reading/Lecture schedule listed in the syllabus and covered in class, even if absent from class for authorized activities.

Academic Integrity:
Academic integrity is fundamental to the process of learning and evaluating academic performance. Academic dishonesty will not be tolerated. Academic dishonesty includes, but is not limited to, the following: cheating, plagiarism, tampering with academic records and examinations, falsifying identity, and being an accessory to acts of academic dishonesty. Refer to the Student Code of Conduct for further information. The Code is available online at ***http://www.studentaffairs.uno.edu***

To ensure academic integrity, all students enrolled in distance learning courses at the University of New Orleans may be required to participate in additional student identification procedures. At the discretion of the faculty member teaching the course, these measures may include on-

campus proctored examinations, off-site or online proctored examinations, or other reasonable measures to ensure student identity. Authentication measures for this course are identified below and any fees associated are the responsibility of the student. The University of New Orleans partners with Proctor U, a live, online proctoring service that allows students to complete exams from any location using a computer, webcam, and reliable internet connection.

Accommodations for Students with Disabilities:
It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities should contact the Office of Disability Services as well as their instructors to discuss their individual needs for accommodations. For more information, please go to *http://www.ods.uno.edu*

Communication Policy:
As a matter of policy at UNO, all *Moodle* accounts are created using only UNO email addresses. If you wish to use a different email address other than your UNO address, it is up to you to set up forwarding from your UNO email account to your desired email address. To simplify matters in communication, I will only use your UNO email addresses. I will post important supplementary course information on Moodle.

Classroom (or Online) Conduct:
Be in class on time. Please do not come late as distracting interruptions are inconsiderate, disrespectful, and time-wasting. There is no excuse for repeatedly arriving late. Parking is often a hassle; allow enough time for it. Cell phones should be turned off before class begins.

Feel free to ask questions of the instructor during class. But please do not ask other students, as talking disturbs teacher concentration and the concentration of other class members.

Civility in the classroom and respect for the opinions of others is very important in an academic environment. It is likely that you may not agree with everything that is said or discussed in the classroom. Courteous behavior and responses are expected.

Expectations of Students:
Students must have Internet access to www.uno.edu and the Moodle portion of ENCE 4328/5328. Often, communications, homework assignments, and project assignments will be done through Moodle and email. Students are responsible for all e-mail communications from the instructor to their UNO email drop box. Help with Moodle can be accessed at http://www.uno.edu/instructional-design/moodle-for-students.aspx.

Students are expected to participate fully in all classroom/online activities. Full participation means that students follow time schedule for all course activities (homework, quizzes, tests, project reports, project presentations, and final exam).

All students are expected to read the material from the textbook ahead of the classroom discussion for active participation in the class. Also, the quizzes given may include material that may not have been covered in the class.