College of Engineering
Department of Civil and Environmental Engineering
Graduate/Undergraduate Syllabus

Course: Air Pollution Control Engineering
Course # CENG 4387(CENG 4350)/CENG 5387
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Welcome to CENG 5387, a graduate level course in air pollution control engineering design and co-listed and a Design Elective as CENG 4387 for undergraduate study. During the upcoming semester, I believe you will find our study of control methodologies to be interesting, challenging, and rewarding as you combine issues of daily air quality and mechanisms for cleaning. Prerequisite CENG 3371 Introduction to Environmental Engineering or equivalent.

Please Note: If you will miss a scheduled class, you are still responsible for the material

I. Course Description:

The course will cover the fundamentals and impact of air pollution on environmental quality and introduce to the process of air monitoring and the design of air monitoring surveys. We will review the policy, regulatory and physical dispersion of air contaminants and then spend the rest of our time looking at engineering controls for specific air pollutants. The course will also introduce the student to better understanding of the physical process and science in contaminant removal devices, atmospheric dispersion of contaminants and the process of air quality planning.

Historically air pollution comes from many different sources such as factories, power plants, dry cleaners, cars, buses, trucks and even windblown dust and wildfires. Air pollution can threaten the health of human beings, trees, lakes, crops, and animals, as well as damage the ozone layer and buildings. Air pollution also can cause haze, reducing visibility in national parks and wilderness areas. Under the Clean Air Act, EPA sets limits on how much of a pollutant is allowed in the air anywhere in the United States. Although national air quality has improved over the last 36 years, many challenges remain in protecting public health and the environment.

SCOPE: The course will cover the fundamentals and impact of air pollution on environmental quality and introduce to the process of air monitoring and the design of air monitoring surveys. The course will also introduce the student to contaminant removal devices, atmospheric dispersion of contaminants and the process of air quality planning

1. **Our course is scheduled as an on-line enrollment; however' there may be times for attendance using a XZOOM platform or MS Teams applications. Provided as determined or as needed through the provided Zoom Portal below. There will be NO recording of the ZOOM so your attendance will be required in the synchronous meeting times. These expectations will be included in the course schedule.**

https://uttyler.zoom.us/j/92904142412?pwd=UTJ6NTMwbGl3eE96aTZCcG1zcVYwQT09

Meeting ID: 929 0414 2412
Passcode: 201339

2. If you will miss a scheduled ZOOM session, you are still responsible for the material. The Presentation slides will be posted in the appropriate section of content in listed modules through the normal CANVAS modules labels as such. However, there will not be posted videos of the lectures. Some of the presentations may have a voice over but the video will not be posted so attendance to the ZOOM lectures is HIGHLY encouraged.

3. You are welcome to seek additional instruction. **I have set aside virtual office hours via ZOOM posted on Canvas.**

https://uttyler.zoom.us/j/92832115880?pwd=c0p3d3dDbytjTmxaOGVGZEF1cjFWQT09
Meeting ID: 928 3211 5880
Passcode: 942002

II. Textbook:

Cooper, C. David, Alley, F.C.., *Air Pollution Control A Design Approach. Third Edition. Waveland Press, Inc.* Illinois, ISBN 1-57766-218-0 or current edition

III. Course Objectives: The student will

A. Be able to identify the major causes of air pollution

B. Be able to classify and define air pollution components.

C. Develop a literacy and understanding of air pollution and its regulation and control

D. Recognize methods for the control of stationary sources for specific contaminants and possible control methods for mobile source air pollutants.

E. Develop solutions for air pollution control based on appropriate chemical and engineering principles and the applicable state or federal standards.

F. Understand the appropriate sampling to quantify and determine air quality and to provide engineering design criteria for control methodologies

G. Demonstrate the ability to predict air pollution behavior using chemical and meteorological data

H. Be able to address the hazards of indoor environmental quality as it relates to ambient air pollution

IV. Course Competencies:

A. Computer-Based Skills
Each student will complete written assignments using word processing programs. Students will also use analytical programs to analyze data and complete assignments.

B. Communication Skills
The student will utilize written and oral skills in presenting the analysis of construction safety plans.

C. Interpersonal Skills
This competency will not be addressed in this course.

D. Problem Solving (Critical Thinking)
The student will use conceptual thinking, quantitative/statistical skills, gathering and analysis of data, and creativity and innovation in analyzing various scenarios discussed in class, as well as in analyzing emissions control plans.

E. Ethical Issues in Decision Making and Behavior
Students will make decisions about air pollution, the effects on neighborhoods and the issues associate with regulation and emission control strategies.

F. Personal Accountability for Achievement
Each student will follow the designated suspense dates and course assignments according to the schedule designated by the instructor.

G. Competence in Environmental Principles
1. By the study of air pollution and air resource planning students will develop a component foundation in air emission control programs and their function on a construction work site.
2. Students may have the opportunity to experience construction safety internships as a result of gaining and mastering the course material.

H. Competence in Engineering Principles Applied to Air Pollution Control
1. The undesirable materials discharged into the atmosphere can have detrimental effects on community health and environmental quality which can be reduced through the use of properly designed engineering systems to control the contaminants
2. Students will learn the engineering design principles for controlling emissions from stationary sources and learn to address mobile sources of air pollution using the fundamental principles of engineering practice.

V. Course Requirements:

A. Assignments
1. Problem sets (12)
2. 3 Design Reviews and Evaluations
3. Midterm Examination
4. Air Pollution Engineering Problem Paper
5. Final Exam

B. Class attendance and participation is required and two or more unexcused absences may result in a one letter grade reduction. Grades reductions for poor attendance will be based upon reasons for excessive absences and overall student performance in class. Students who are required to participate in official University event or activity will be required to meet with the instructor prior to the absence and make

arrangements to make up all work missed during the absence. Due dates for written submissions will not be waived, if a student must be absent on a due date the paper must be received by the instructor prior to the absence.

C. Weighted Grade Distributions*

1.	Problem Sets	300 points
2.	Design Reviews and Evaluations	300 points
3.	Mid Term Exam	350 points
4.	Attendance and Participation	200 points
5.	Engineering Problem Paper	300 points
6.	Final Exam	500 points
	Course Accumulation Total	2000 points

Individual effort graded events (Exams (2), Problem Paper) will account for 55% of the course grade while problem sets and design reviews will account for 35% of the course grade. The final 10% of the course grade will come as a result of class participation, posting questions, responses to student and instructor questions and miscellaneous interaction through the CANVAS site. Time allocation to CANVAS activity will be tracked for each student. All course requirements will be graded by a percentage calculation based on correct answers, completeness and quality of work, as appropriate. Late work will be accepted according to individual work policy as described below.

Final Course Grades will be based upon the accepted University grading scale for

	Undergraduate work	**Graduate work**
A	1800 – 2000 points	2610 – 3000
B	1600 – 1799 points	2550 – 2609
C	1400 – 1599 points	1890 – 2549
D	1200 – 1399 points	N/A
F	<1199 points	<1889

D. Work Assignments

1. Problem Sets (PS)

i. Fold your work and include on the folded leaf a cover page as indicated

Student's Name
Course Title
Date Submitted
Problem Set #

ii. **Use Engineer paper only or full-page printouts from MathCAD, Excel, Visual Analysis, or similar program.** You may neatly tape or glue short computer printouts onto Engineer paper at the appropriate place in the logical flow of the problem. Only use one side of a page. Clearly present **a brief problem statement and a sketch** with your solution. (See Example in Class) Clearly and concisely explain each step. For narratives of more than a line or two, use your word processor or the text capability if you are using MathCAD or Excel. If you are writing out a paragraph or more, it must be very legible.

iii. Late Submissions. It is a basic principle of professionalism that **"Professionals are not Late."** A "COORDINATED LATE" submission occurs when you will miss the suspense for a graded homework

assignment, and you contact me in advance. Notification immediately before the submission will not suffice. Point cuts up to the amounts below **may** be assessed for a "COORDINATED LATE" submission:

0-24 hours late - deduction of 25% of the earned grade
2. 24-48 hours late - deduction of 50% of the earned grade
3. More than 48 hours late - No credit.

All assignments must still be submitted to receive a course grade.

Obviously, there are circumstances that will occur and make a timely submission impossible and I will work with you if and when they occur.

iv. All homework in this course must be properly documented. As you are having your work reviewed it is likely that you might receive help from your classmates, just simply document it. Information from the course textbooks (equations and outlines of procedures), class notes, or my assistance is considered immediately available to all students and need not be acknowledged or documented. **YOU ARE REQUIRED TO ACKNOWLEDGE AND DOCUMENT ALL OTHER ASSISTANCE AND REFERENCES USED.** Documentation will be accomplished in accordance with any manual for writing, footnote or endnote, for papers, but for written homework, just place the documentation right at the point you received help using Who and what assistance.

2. Design Reviews and Evaluations (DRE)
   i. Each student will be given a design for pollution control or other evaluations of air quality based on previous work. The assignment will be for the student to complete a review of the proposal provided
   ii. The review should include any assumptions that the student uses in completion of the review, not already stated by the original designer. The review will also contain a determination of control appropriateness by identifying a specific contaminant regulation limit, an assessment of fundamental principles of control, a calculation of efficiency in the collection of a given contaminant stream and the likelihood of success for the design presented.

   iii. Submission requirements for the DRE are the same as identified for the problem sets above.

3. Engineering Problem Paper (EPP)
   Information to be provided at a later date

E. Suspense Dates

Refer to Class schedule provided.

VI. Course Outline General content:
(Proposal of Possible to Course Schedule for actual lecture topics and delivery order):

A. Introduction:

1. Air Pollution Episodes
2. History of Enacted Laws
3. Clean Air Act and Its Amendments
4. Symbols and Terminology of Air Pollution

B. Air Pollution and its Effects

1. Health concerns of contaminants
2. Chronic Low-Level Contaminants
3. Particle Size Effects Health
4. Ambient Concentrations of Toxics
5. Risk and Standard Setting
6. Air contaminant classification and identification
7. Basic Atmospheric chemistry
8. Sources of air pollution

C. Atmospheric Events and Source Effects

1. Meteorology
2. Determinants of Air Pollution
3. General Characteristics of Stack Plumes
4. Dispersion of Pollutants and Modeling

D. Engineering Control Air Pollution

1. Particulate Control Theory
2. Particle Control Processes
3. Gas and Vapor Control Theory
4. Gas and Vapor Processes
5. Special Application of Control Theory (Combustion By-Products
    a. Sulfur Oxide and Acid Gas Control
    b. Nitrogen Oxide Control
    c. Carbon Monoxide
    d. Secondary Reactants (photo chemicals)

E. Other topics for consideration or Graduate Research Presentations

1. Real Time Monitors
2. Sampling Train and Hi-Vol Samplers
3. Laboratory Analysis
4. Thermodynamics
5. Photooxidation
    a. Oxygen and Ozone Formation

b. Oxides of Nitrogen
c. Polycyclic aromatic hydrocarbons (PAH) and Peroxyacetyl nitrates (PAN)
d. Hydrocarbon Reactivity
e. Daily History and Photochemical Smog
f. Control Strategies

VII. References

De Nevers, *Air Pollution Control Engineering*, 2nd Edition, McGraw Hill Press, Boston, MA, (2000).

Stern, Wohlers, Boubel and Lowry, *Fundamentals of Air Pollution*, Academic Press, New York, (1973).

Alley and Associates, *Air Quality Control Handbook*, McGraw Hill, New York, (1998).

Noll and Duncan, *Industrial Air Pollution Control*, Ann Arbor Science, Ann Arbor, MI (1975).

Cooper and Alley, *Air Pollution Control: A Design Approach*, 4th Edition, Waveland Press, Prospect Heights, IL, (2011).

Powals and Zanre, *Sampling Time Estimating Manual*, Technomic Publishing, Westport, CT, (1974).

Stevens and Herget, *Analytical Methods Applied to Air Pollution Measurements*, Ann Arbor Science, Ann Arbor, MI (1974).

Katz and Jenniss, *Regulatory Compliance Monitoring by Atomic Absorption Spectroscopy*, Verlag Chemie International, Deerfield Beach, FL, (1983).

Hess, *Environmental Sampling for Unknowns*, CRC/Lewis Press, Boca Raton, FL, (1996).

Weiner, *Applications of Environmental Chemistry*, Lewis Press, Boca Raton, FL, (2000).

Briggs, *Plume Rise*, US Atomic Energy Commission, (1969).

Wark, Kenneth, Warner, Cecil F., and Davis, Wayne T. Air Pollution Its Origin and Control, Addison Wesley Longman, Inc., Menlo Park, 1998.

Turner, *Workbook of Atmospheric Dispersion Estimates*, USEPA, Cincinnati, OH, (1969)

Dattmer and Hopke, *Proceedings of Receptor Models Applied to Contemporary Pollution Problems*, Air Pollution Control Association, (1982).

University Policies and Procedures

1. Social Security and FERPA Statement.

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

2. UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

3. Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

4. Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class if on the campus of UT Tyler. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

5. UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

6. Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. (For Fall, the Census Date is Sept. 12.) Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date (Sept. 2nd) is the deadline for many forms and enrollment actions of which students need to be aware. These include:

1) Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit
2) Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
3) Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)

4) Being reinstated or re-enrolled in classes after being dropped for non-payment
5) Completing the process for tuition exemptions or waivers through Financial Aid State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

7. Student Accessibility and Resources

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University offers accommodations to students with learning, physical and/or psychiatric disabilities. If you have a disability, including non-visible disabilities such as chronic diseases, learning disabilities, head injury, PTSD or ADHD, or you have a history of modifications or accommodations in a previous educational environment you are encouraged to contact the Student Accessibility and Resources (SAR) office and schedule an interview with the Accessibility Case Manager/ADA Coordinator, Cynthia Lowery Staples. If you are unsure if the above criteria applies to you, but have questions or concerns please contact the SAR office. For more information or to set up an appointment please visit the SAR office located in the University Center, Room 3150 or call 903.566.7079. You may also send an email to cstaples@uttyler.edu

8. Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

9. Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

10. Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

11. Emergency Exits and Evacuation

If on the UT Tyler campus, everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

12. Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

a. "Cheating" includes, but is not limited to:
1. copying from another student's test paper;
2. using, during a test, materials not authorized by the person giving the test;

3. failure to comply with instructions given by the person administering the test;
4. possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
5. using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
6. collaborating with or seeking aid from another student during a test or other assignment without authority;
7. discussing the contents of an examination with another student who will take the examination;
8. divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
9. substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
10. paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
11. falsifying research data, laboratory reports, and/or other academic work offered for credit;
12. taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
13. misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

    i. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.
    ii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

All written work that is submitted will be subject to review by UniCheck COE, available on CANVAS.

13. <u>UT Tyler Resources for Students</u>

1. UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
2. UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
3. The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
4. UT Tyler Counseling Center (903.566.7254)