PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

HAZARDOUS WASTE CONTROL W/LAB
CHT 2650

Class Hours: 3.0   Credit Hours: 4.0
Laboratory Hours: 3.0   Date Revised: Fall 01

NOTE: This course is not designed for transfer credit.

Catalog Course Description:

A study of the interaction of waste materials and the environment. The treatment and disposal of waste materials will be discussed with emphasis on disposal of hazardous waste materials. The laboratory work will demonstrate analysis and disposal techniques for hazardous wastes. Field trips will be included, as appropriate. Accuracy in following procedures and recording data in a prescribed format will be emphasized.

Entry Level Standards:

Students will need a mathematical preparation equivalent to introductory college algebra and background in general chemistry equivalent to two semesters of college introductory general chemistry, with an elementary introduction to mass and energy balances. Students should be familiar with standard chemical laboratory operations and with the keeping of an experimental laboratory notebook.

Prerequisites:

CHEM 1110, MATH 1731

Textbook(s) and Other Reference Materials Basic to the Course:

_Hazardous Waste Management_ by C.A.Wentz
Composition Book, 1/4 or 1/5 inch quadrille ruled, 9 3/4” x 7 1/2”, 54 sheets, Boorum and Pease Company #09-4158 or equivalent.

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Gaseous and Particulate Pollutants: Identity and Chemistry, Physiology and Toxicity, Air Quality Standards</td>
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<tr>
<td>2</td>
<td>Gaseous and Particulate Pollutants: Primary Emission Standards, Secondary Standards and Offsets, Integrated Gas Cleaning Systems</td>
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<tr>
<td>3</td>
<td>Gaseous and Particulate Pollutants: Gas Dispersion from Stacks, Adiabatic Lapse Rate and Dispersion, Winds and Dispersion</td>
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II. Course Objectives*:

A. Identify gaseous pollutants in typical chemical processing waste gas streams and in relating those pollutants quantitatively to regulatory standards for limits on concentrations and
emission rates of those pollutants. I, II, III, V

B. Identify the types of processing operations and equipment appropriate for removal of common, typical pollutants in industrial gaseous wastes and specifying typical ranges of the operating parameters appropriate for meeting governmental emission standards. I, II, III, V

C. Identify EPA-approved analytical sampling systems designs for the major gaseous pollutants, with understanding of the intended functions of components within those systems for operating them properly to acquire data in compliance with regulatory requirements. I, II, III, V

D. Identify dissolved pollutants in typical chemical process wastewaters and relating the concentrations of these pollutants to quantitative specifications on the concentration levels and rates of emission of pollutants. I, II, III, V

E. Identify the types of processing operations and equipment appropriate for removal of common, typical pollutants in industrial wastewaters and specifying the ranges of typical operating parameters for meeting effluent specifications. I, II, III, V

F. Apply standard statistical tests and evaluations including confidence intervals, linear regression, correlation coefficients, t-tests for differences of means and f-tests for ratios of variances to wastewater leaching and treatment data. I, II, III, IV, V

*Roman numerals after course objectives reference goals of the CHT program

III. Instructional Processes*:

Students will:

1. Attend lectures and discuss concepts. Communication Outcome, Problem Solving and Decision Making Outcome, Information Literacy Outcome, Active Learning Strategy

2. Solve assigned problems out of class and be prepared to discuss the problem solutions. Communication Outcome, Problem Solving and Decision Making Outcome, Numerical Literacy Outcome, Information Literacy Outcome, Active Learning Strategy

3. Participate in laboratory experiments which are direct applications of the concepts studied. Communication Outcome, Problem Solving and Decision Making Outcome, Technological Literacy Outcome, Information Literacy Outcome, Active Learning Strategy, Transitional Strategy

4. Work as part of a group to perform laboratory experiments and collect data. Communication Outcome, Personal Development Outcome, Problem Solving and Decision Making Outcome, Cultural Diversity and Social Adaptation Outcome, Technological Literacy Outcome, Information Literacy Outcome, Active Learning Strategy

5. Maintain a research style lab notebook. Communication Outcome, Information Literacy Outcome, Active Learning Strategy

6. Prepare a formal written report evaluating the students' experimental results. Communication Outcome, Information Literacy Outcome, Active Learning Strategy

7. Give a short oral presentation of the report will be made. Communication Outcome, Technological Literacy Outcome, Information Literacy Outcome, Active Learning Strategy

*Strategies and outcomes listed after instructional processes reference Pellissippi State’s goals for
strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

Upon successful completion of this course, the student should be able to:

1. Identify the common atmospheric pollutants. A
2. Identify typical physiological effects of common pollutants. A
3. Understand governmental air quality and emission standards for gaseous pollutants. A
4. Relate emission standards to air quality standards via dilution factors. B
5. Explain the main functions of the major components in gas cleanup systems. B
6. Calculate the dispersion of pollutants from stacks using simplified, conservative, flow and mixing modeling assumptions. B
7. Understand adiabatic lapse rate in meteorology and its qualitative relationships to gaseous pollutant dispersal in the atmosphere. C
8. Calculate the theoretical capacity of fixed-bed absorbers for gaseous pollutants. C
9. Calculate the ideal performance of fluidized bed absorbers for removing pollutants from process waste gases. C
10. Generalize the ideal quantitative behavior of a single fluid bed absorber to the quantitative effect of cascaded absorbers. C
11. Specify the number and locations of sampling points needed to define the bulk flowrate and the average composition of process waste gas streams. C
12. Specify temperatures and flowrates for adequate incineration of organic pollutant vapors. C
13. Identify special pollutants which poison catalysts use in treatment of gaseous wastes. C
14. Calculate the quantitative removal of soluble or condensable pollutant vapor from gases passing through heat exchangers. C
15. Calculate the quantitative removal of soluble or condensable pollutant vapor from gases passing through scrubbers. C
16. Use graphical data to calculate removal of particulate pollutants of known particle size from process waste gases in conventional and novel collection equipment. C
17. Calculate gas flowrate from Pitot tube data. C
18. Specify the functions of the components in EPA analytical sampling systems for moisture, sulfur oxides, nitrogen oxides, particulate, organic vapors and opacity. C
19. Know the main features of Federal law regulating waste-water composition and its disposal to the environment. C
20. Understand the general relation of dissolved oxygen in water to aquatic ecology. D
21. Understand the relation of typical organic wastewater pollutants to lowering dissolved oxygen levels in water.  D
22. Calculate the theoretical BOD of wholly biodegradable, identified, typical organic pollutant compounds dissolved in water.  D
23. Understand the qualitative distinction between BOD and COD in partially biodegradable compounds.  D
24. Identify special, highly toxic pollutants that interfere with normal biopurification processes in wastewater.  D
25. Calculate the sizes of equipment needed for primary treatment of wastewaters with known flowrate and having typical properties.  E
26. Calculate the size of equipment needed for secondary treatment of wastewater having known flowrate and BOD, to achieve a given BOD reduction.  E
27. Understand qualitatively the drawbacks and the advantages of wastewater sterilization and COD reduction (tertiary treatment).  E
28. Specify quantitatively the process stream parameters for typical sewage sludge dewatering and anaerobic digestion operations on the solids produced by primary and secondary treatments.  E
29. Determine the advantages and the drawbacks of alternative final disposal methods for digested sludge from wastewater treatment systems.  F
30. Integrate, conceptually, the separate steps of wastewater treatment into an overall system.  F

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures:

Five one-hour (50 minute) written tests will be given during the semester. A written, one-hour comprehensive final examination will be given after the end of regular classes. Each test has equal weight in calculating the lecture course grade. The final examination has the weight of two tests in calculating the lecture course grade.

The average grade of all assigned homework has the weight of a one-hour test in calculating the overall course grade. The two lowest grades among the homework average and the five tests will be dropped when calculating the course average grade. Makeup tests will not routinely be given. A test which is missed will be dropped, as one of the two drops described earlier. If two tests are missed, they will be the two dropped test grades and the homework grade will be included in the course grade. If more than two tests are missed, a test score of zero will be assigned to each missed test beyond two.

B. Laboratory Expectations:

The laboratory course grade is assigned separately from the lecture course grade and is based on report writing, keeping of a laboratory notebook, and experimental competence. Each student will write a formal research report and a short oral presentation of the report will be made. Each laboratory session has equal weight in determining the laboratory course grade. A final comprehensive report on the results of laboratory sessions 2 through 12 will be written. The final comprehensive report will have the weight of two laboratory sessions.
The schedule of laboratory assignments for each week of the semester is:

1. Laboratory orientation and safety
2. Preparation of buffer solutions for leaching experiments
3. Preparation of waste solids samples for leaching experiments
4. Atomic absorption spectrophotometric analysis of leachates
5. Statistical analysis of leachate data (single groups)
6. Atomic absorption spectrophotometric analysis of leachates
7. Statistical analysis of leachate data (single groups)
8. Preparation of leachates for purification treatment
9. Purification of leachates by coagulation and adsorption
10. Atomic absorption analysis of purified leachate samples
11. Statistical analysis of purification processes results
12. Statistical analysis of "pooled" data from all students
13. Decontamination of wastewater by ion exchange
14. Elution of collected contaminant from ion exchange resin
15. Statistical analysis of ion exchange absorption-elution data

C. Field Work:

Either a special plant trip requiring a trip report be taken in place of a laboratory session, or a special homework assignment requiring library research into reference materials will occur during the course.

D. Other Evaluation Methods:

N/A

E. Grading Scale:

The percent grade ranges for the overall course letter grades are:

90 – 100 A
87 – 89 B+
80 – 86 B
77 – 79 C+
70 – 76 C
60 – 70 D
below 60 F

VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course (Pellissippi State Catalog). Individual departments/programs/disciplines, with the approval of the vice president of Academic and Student Affairs, may have requirements that are more
stringent.

Chemical/Environmental Engineering Technology Program:
Regular attendance in this course is required. Students who miss the equivalent of 10% of either classroom hours or laboratory may, at the discretion of the instructor, have their course grade dropped by one letter. Students who arrive late for a class after the roll as been called have the responsibility of seeing the instructor after class the change their status from A (absent) to T (tardy).

B. Academic Dishonesty:

In keeping with college-wide policies, the student is expected to adhere to the general rules and regulations relevant to academic and classroom misconduct as outline in the catalog. A first case of cheating on a test will result in a grade of zero being assigned to that test. A second case of cheating will result in dismissal from the class with a course grade of "F".