DOC. 149

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: WATER CHEMISTRY

Code No.: CHM 230-4

Program: ENVIRONMENTAL/PULP & PAPER/ WATER RESOURCES ENGINEERING TECHNOLOGY

Semester: THREE/FOUR

Date: MAY 1993

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APPROVED: _____ June 30/93
Dean, School of Sciences & Natural Resources — Date

CALENDAR DESCRIPTION

WATER CHEMISTRY	CHM 230-4
COURSE NAME	COURSE NUMBER

PREREQUISITE: CHM 218-4, MTH 256

PHILOSOPHY/GOALS: This course is an introduction to the chemistry of natural and polluted waters. The concepts taught in CHM 230 will be applied in later courses dealing with water and wastewater treatment. The purpose of such a course is to provide students with a knowledge of what pollutants are likely to be found in the water and some of the typical analyses that are done on a routine basis.

The student will develop his/her ability to communicate effectively by completing a formal laboratory report on each analysis performed.

In addition to the compulsory labs, additional topics include the following: Phosphate, Flouride, Kjeldahl Nitrogen, Gas Solubility, etc.

GRADING METHOD (EVALUATION):

Theory (includes Midterm & Final)	50%
Lab - 6 labs	50%

NOTE: There is no supplemental exam or re-write as such.

Theory work during the term is 25% of final grade.

Lab - 6 labs 50%

A+	> 90%
A	80-89%
B	70-79%
C	60-69%
R	< 60%

All assignments and labs must be submitted the day they are due. Late assignments will not be marked, while late lab assignments lose 10% per week for lateness.

The following rule applies to attendance: **ALL STUDENTS ARE REQUIRED TO ATTEND 80% OF THEORY CLASSES AND 100% OF LAB CLASSES UNLESS A PRIOR ARRANGEMENT WITH THE INSTRUCTOR HAS BEEN OBTAINED.**

WATER CHEMISTRY — COURSE NAME

CHM 230-4 — COURSE NUMBER

TEXTBOOK(S):

Braun, Introduction to Chemical Analysis. McGraw-Hill, 1982.

W/W 80 Procedures and Test Equipment for Water/Wastewater Analyses. (Fisher Scientific, 1983.)

Sampling for Water Quality Environmental Control.

Water Quality Sourcebook. Environment Canada. 1979.

INTRODUCTION:

CHM 230 is a continuation of the Analytical Concepts begun in CHM 218 (Semester 2). However, CHM 230 focuses on water quality parameters in both theory and lab parts of the course. The course involves two hours of theory and a lab each week. A total of six labs are required for the course. These include the following: Acidity, Alkalinity, pH, D.O., B.O.D., C.O.D., Hardness, Conductivity, and Turbidity, plus an experiment of the student's choice.

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

1. Make calculations required for solution preparation using M, N, ppm.

2. Make calculations involving acidity (expresses as mg/v C_aCo_3), pH, H^+ & OH^- concentrations and be able to calculate the pH of a final effluent based on the knowledge of flow and pH of contributing flow from a number of servers.

3. Make calculations involving alkalinity (expressed as mg/v C_aCO_3) for p-ALK, MO-ALK +-ALK and alkalinity as carbonate and bicarbonate for waters containing the five types of alkalinity.

4. Make calculations involving hardness (expressed as mg/L C_aCO_3) for t-hardness NCH and CH.

5. Draw bar graphs and make calculations given analytical results of a typical water analysis.

6. Make calculations and discuss the accuracy of analytical results of typical water analysis.

7. Solve problems related to various physical chemical treatment of wastewater. Examples involve Redoc and precipitation reactions.

8. Graph results of potentiometric titration and determine the equivalent point using the first derivative curve.

9. Make calculations for BOD_5, DOD_u using typical data for municipal and industrial plants using Regression Analysis.

10. Make calculations for COD using Regression Analysis.

11. Prepare calculation curve and using Regression Analysis determine the concentration based on Spectrophotometric data.

Time Frame for various topics:

Acidity - 6 h
Alkalinity - 4 h
Hardness - 2 h
DO/BOD/COD - 6 h
Problem solving - 3 h
Instrumental methods - 3 h
Miscellaneous - 4 h
Testing - 2 h

TOTAL 30 HRS

FORMAT FOR LABORATORY REPORTS

1. All pages of the lab book should be numbered. Do this as soon as you purchase it. Number at the middle of the bottom of the page.

2. Page 1 is used for your name, address, course number for which the lab book is to be used and any additional information.

3. The next three pages are used for a Table of Contents or Index. This is to be completed as you complete your experiment.

4. Each experiment is to be documented using the following format:

A. Table of Contents

B. Exp. # Title of Experiment Starting Date

C. Prelab:
- Apparatus required to perform this experiment.
- Chemicals to be used in this experiment.
- Any hazards that should be noted regarding the chemicals used.
- Solutions required in this experiment. Calculations showing preparation of 1 L of the solution is to be shown.

D. Objectives:
- These must be written in a manner which indicates what you are attempting to do. Example - To prepare 1 L of a 0.1M NaOH solution using NaOH pellets.
- Each objective is to be numbered.
- Each objective begins with "To".
- Each objective must be measurable by the instructor.

E. Abstract:
- This is composed of one or more paragraphs.
- Total length is 50-250 words.
- Briefly explains what you did in the experiment.
- Gives the results that you obtained.
- Compares your results with known values, etc.
- Includes statistical analysis of data.

F. Procedure:
- Usually a reference to where the method comes from.
- Includes any differences that you make from the prescribed method.
- Full reference is required.

G. Theory:
- Is written in your own words.
- Gives the theoretical basis for the method used.
- Derives all equations used, mathematical as well as chemical.
- Must be written in complete sentences and paragraphs.
- All terms must be defined in theory.

H. Data:
- Is to be in table format.
- Must be logical and flow smoothly from statement to statement.
- Must include all data collected and calculated values.
- Correct number of significant figures must be maintained.

I. Calculations:
- A sample calculation showing the result must be included.
- Mathematical equation used must be shown.
- Simple arithmetic steps need not be shown.
- All statistical analysis must be shown, eg. mean, precision, standard deviation, etc.
- Graphs of data and of results where pertinent.

J. Discussion of Results and Source of Errors:
- Results must be discussed with regards to precision and accuracy.
- Compare results to known values.
- Express relative error when using unknown.
- Source of error must be discussed as to how it applies to your experiment.
- All graphs must be discussed.

K. Conclusions:
- Are keyed to objectives.
- Each objective requires a conclusion.
- Must be complete.

L. Bibliography:
- Fully referenced.
- Includes all books, journals, etc. used in the preparation of report.

M. Sign the end of your report and date it showing date completed.

Notes: All data collected in the lab is to be recorded on the left hand side of the page. This is your rough data. It is to be recorded neatly. Data must not be recorded on slips of paper.

The report is to be written only on the right hand pages. Graphs may be on the left hand pages if necessary.

POSSIBLE 6TH EXPERIMENTS FOR CHM 230

1. Volumetric determination of t-Fe using $K_2 Cr_2 0_7$.
2. Determination of Calcium and Magnesium using AAS.
3. Volumetric determination of Water Hardness.
4. Spectrophotometric analysis of nitrites.
5. Fluoride analysis using specific Ion electrode.
6. Sulphate analysis using turbedemetric method.
7. Determination of Iron Spectrophotometrically.
8. Spectrophotometric determination of phosphate.
9. BOD of an Industrial Effluent.
10. Acidity of an Industrial Waste Effluent.
11. Bioassay - Toxicity study.
12. Volumetric determination of sulphide.
13. Solubility of 0_2 as a function of temperature.
14. Determination of well water alkalinity using Instrumental Method.