SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE MARIE, ON

COURSE OUTLINE

Course Title;   Advanced Wastewater Treatment

Code No.: WTR 327-5   **Semester**: V

Program; Water Resources/Environmental Engineering

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Date; April 1998   **Previous Outline Date**; April 1995

Approved: TH^V'V^/^V^-^_____ ^^U^ _///^jr_
                            Dean   ^ Date

Total Credits; 5   **Prerequisite(s)**: WTR 226
Length of Course: 16 weeks   **Total Credit Hours**: 80

L   COURSE DESCRIPTION:

To present basic knowledge and practices, theories, and applications rdevant to the wastewater treatment of wastewaters. The course w<Hic uHll involve biological, physical and chemical processes, and sludge treatmoit and disposal methods.

n.   LEARNING OUTCOMES **AND** ELEMENTS **OF** THE **PERFORMANCE:**
(Generic Skills Learning Outcomes placement on the course outline will be determined and communicated at a later date.)

Upon successful completion of this course the student will demonstrate the ability to:

1)   Activated Sludge Process

Potential Elements of the Performance:

- Identify the characteristics of wastewater
- Classify various types of biological treatment processes
- Name the main variations of the activated sludge process
- Perform process calculations
- Evaluate the performance of an activated sludge process
- Describe the various ways to control an activated sludge process
- Do the laboratory tests to evaluate and control the process

2)   Sludge Processing

Potential Elements of the Performance:

- Describe the sludge production as part of primary and secondary treatment
- Compare primary and secondary sludges
- Do a mass balance to estimate sludge quantities
- Classify the sludge treatment and handling processes
- Describe sludge digesters

3)   BOD Reaction and Stream Pollution

Potential Elements of the Performance:

- Understand the reaction kinetics
- Use BOD reaction rate equation
- Perform a BOD test and evaluate reaction rate constant
- Describe organic pollution of stream waters
- Describe and use elementary water quality model

n.   LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE (Continued)

4)   Pre-Treatment of Industrial Wastes

Potential Elements of the Performance:

- Classify various types of pre-treatment processes
- Perform dosage and dosage rate calculations

5)   Development of Head Works Loadings

Potential Elements of the Performance:

- Understand the need for using the local limits
- Describe various criteria as used for determining local limits
- Perform calculations for allocating pollutant loadings

6)   Advanced Wastewater Treatment Processes

Potential Elements of the Performance:

- Distinguish between advanced and tertiary treatment processes
- Classify advanced wastewater treatment process
- Perform calculations to size the equalization basins
- Compare wastewater filtration to potable water filtration systems
- Describe the chemical and biological processes of phosphorus removal
- Describe nitrification and denitrification processes
- Understand the wastewater treatment processes commonly used for pulp and paper, food, steel, auto and chemical industries

m.   TOPICS:

1) Review of Treatment Processes (Chapter 12)
      1.1   Defibiition and classification
      1.2   Activated Sludge Process variations
      1.3   Factors affecting Activated Sludge Process
      1.4   Process Control and Operational parameters

2)   Processing of Sludges (Chapter 13)
  2.1   Sources, Characteristics and Quantities of Waste Sludges
  2.2   Arrangement of Unit Processes in Sludge Di^osal
  2.3   Sludge Digestion
  2.4   Vacuum and Pressure Filtration

3)   Water Quality and Pollution (Chapters 15, 8)
  3.1   BOD Reaction
  3.2   Types and Sources of Stream Pollution
  3.3   Aeration and Deoxygenation of Stream Waters
  3.4   An Elementary Water Quality Model

4)   Pre-Treatment of Industrial Waste
  4.1   Neutralization
  4.2   pH Adjustment
  4.3   Hydroxide Precipitation
  4.4   Metal Precipitation

5)   Development of Headworks Loadings
  5.1   Definition and Purpose
  5.2   Derivation of Local Limits
  5.3   Allocation of Loadings

6)   Advanced Wastewater Treatment Processes (Chapter 14)
  6.1   Effluent Standards and Flow Equalization
  6.2   Selection of Advanced Wastewater Treatment Processes
  6.3   Granular Media Filtration
  6.4   Carbon Absorption
  6.5   Phosphorus Removal
  6.6   Nitrogen Removal
  6.7   Wastewater Reclamation

IV.   REQUIRED RESOURCESyXEXTS/MATERIALS:

Water Supply & Pollution Control, by Warren Viesman, Jr. and Mark J. Hammer. S*
Edition, Harper and Row PubUshers, New York. (1993).

Course Manual by S. Verma, ETS Inc.

**ADDInONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE
LIBRARY BOOK** SECTION:

Wastewater Treatment, by Donald W. Sundstrom and Herbert E. Klei, Prentice-Hall, Inc.
Englewood Cliffs, N.J. 07632. (1979).

Water and Wastewater Technology (SI Version) by Mark J. Hammer. John Wiley &
Sons, (1987) 2"^ Edition.

Industrial Water Pollution - Origins. Characteristics and Treatment, by Nelson L.
Nemerson. Addison-Wesley Publishing Company, Don Mills, Ont. (1978).

Water Quality, by George Tachobanoglous and Edward D. Schoreder. Addison-Wesley
Publishing Company, Don Mills, Ontario. (1985).

EVALUATION PROCESS/GRADING SYSTEM

    Laboratory Work   25%

    Unit Tests   75%

GRADING: A+ 90 -100%
        A 80- 89%
        B 70- 79%
        C 60- 69%

A passing grade will be based on a minimum composite grading of 60%.

ADDITIONAL NOTES:

The following laboratory experiments/exercises are planned:

1.   Process evaluation and control of an activated shidge process.

2.   Study the characteristics and quantities of primary, secondary and processed sludges.

3.   Acidity/Alkalinity of anaerobic digesting sludge.

4.   Study the design and operation of sludge digesters.

5.   Determine the ultimate BOD for a given wastewater sample.

6.   Determine the **BOD** curve for a given sample using a respirometer, and hence calculate the **reaction** rate constant.

7.   Compute the maximum oxygen deficit (oitical) in a stream receiving wastewater using simple **water** quality model.

8.   Study the phosphorus removal efficiency with and without chemical treatment.

9.   Trace nitrogen in a secondary plant with and without significant nitrification.

NOTE:

Reports are due one week after an exercise is performed. Late submissions will be penalized.

VI.   SPECIAL NOTES:

-    Special Needs
     If you are a student vdth special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room El204, Ext. 493, 717, 491 so that support services can be arranged for you.

-    Retention of Course Outlines
     It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other post-secondary institutions.

-    Substitute Course Information is available at the Registrar's Office.

Vn.   PRIOR LEARNING ASSESSMENT

Students who wish to apply for advanced credit in the course should consult the instructor.