SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

Sault College

COURSE OUTLINE

COURSE TITLE: HYDRAULICS

CODE NO. : WTR 330 **SEMESTER:** III

PROGRAM: Civil/Environmental-Water Engineering Technology

AUTHOR: *Subhash Verma, P.Eng*

DATE: May, 2008 **PREVIOUS OUTLINE DATED:** June 2003

APPROVED:

"Brian Punch"

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Chair **DATE**

TOTAL CREDITS: 5

PREREQUISITE: PHY 100

HOURS/WEEK: 4

I. COURSE DESCRIPTION:

To introduce the basic principles of fluid mechanics and the application of these principles to practical and applied problems. After completing this course the student should have a firm foundation in the field to continue learning. This course will provide the understanding of basic concepts of fluid mechanics and application of these concepts to solve real world problems in the area of specialization including hydrology, water supply, storm water management and process control.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Perform unit conversions using the procedure of unit cancellation.

    - Define the terms fluids and fluid mechanics
    - Derive units of force, energy and pressure in SI and English systems of units
    - Perform unit conversions and cancellations
    - Select the appropriate significant figures

2. Define, express and relate the properties of fluids

    - Define the tem density, weight density and specific gravity
    - Derive the relationship between mass density and weight density
    - Express pressure as equivalent liquid column
    - Differentiate between gauge pressure and absolute pressure
    - Explain the role of viscosity in fluid flow

3. Describe the behaviour of fluids at rest

    - Discuss the three forms of fluid energy
    - Express the fluid energy as head
    - Derive the relationships between pressure and elevation
    - Measure fluid pressure using manometers and gauges
    - Calculate the forces acting on retaining walls and buoyant forces on bodies immersed in fluids

4. Apply the principles of mass conservation and energy conservation to fluids in motion.

- Derive and apply continuity equation to size the pipes
- Apply the concept of energy conversation to write Bernoulli's equation
- Recognize the limitations of Bernoulli’s equation
- Define Toricelli's theorem
- Describe the working principles of variable head meters

5. Modify Bernoulli's equation to general energy equation.

   - Identify hydraulic mechanics like pumps and turbines
   - Expand Bernoulli's equation to include the terms head added and head lost apply energy equation to solve practical problems
   - Calculate the power required to drive pumps
   - Draw hydraulic and energy grade line for a fluid system

6. Apply the principles of fluids mechanics to flow measurement.

   - Derive general flow equation for variable head meter
   - Study a venture meter in the laboratory
   - Derive the equation relating coefficients of discharge, velocity and contraction
   - Calculate the velocity of flow using Pitot-static tube
   - Apply weirs formula to estimate flow in open channel

7. Identify factor affecting fluid flow and compute the head loss in a fluid flow system.

   - Characterize laminar flow and turbulent flow
   - Use Moody's chart to determine friction factor
   - Computer frictional head loss by applying Darcy Weisbach flow equation
   - Calculate minor losses due to expansion, contraction and fittings

8. Apply energy equations to analyze pipeline systems.

   - Differentiate between series and parallel pipeline systems
   - Identify whether a given system is class I, class II and class III systems
   - Apply Hazen Williams flow formula

9. Describe the selection of pumps to serve a fluid flow system

   - Classify pumps by their displacement
   - Apply affinity laws to evaluate the pump performance
   - Determine the performance to geometrically similar pumps

- Calculate the maximum permissible suction lift
- Study the operation characteristics of a pump in the lab

10. Apply Manning's flow equation to size drainage ditches, sewers and calculate flow carrying capacity.

    Potential Elements of the Performance:

    - Interpret Manning's equation and its empirical form
    - Compute normal discharge of a open channel
    - Size a sewer to carry a given flow
    - Define specific energy and critical flow conditions
    - Describe the phenomenon of hydraulic pump
    - Study the open channel hydraulics in lab

III. TOPICS:

1. Systems of Units
2. Fluid Properties
3. Fluid Statics
4. Fluid Kinematics
5. General Energy Equation
6. Flow Measurement
7. Energy Losses
8. Flow Equations
9. Pump Selection
10. Open Channel Flow

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Mott, Robert, (2005), Applied Fluid Mechanics, Sixth Edition, Prentice-Hall
Verma, S. C. (2008), Hydraulics – Course Manual, ETS

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade will be derived from the results of the tests and lab work and assignments, weighted as follows:

Tests	- 50%
Quiz Tests	- 25%
Lab Work	- 25%

To pass the course a minimum of 50% score is required.
The following semester grades will be assigned to students in postsecondary courses:

Grade	Definition	Grade Point Equivalent
A+	90 - 100%	4.00
A	80 - 89%	4.00
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 - 59%	1.00
F (Fail)	49% and below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:

Special Needs:
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Special Needs office. Visit Room E1101 or call Extension 2703 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 postsecondary institutions.

Communication:
The College considers ***WebCT/LMS*** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the ***Learning Management System*** communication tool.

Plagiarism:
Students should refer to the definition of "academic dishonesty" in *Student Code of Conduct*. Students who engage in "academic dishonesty" will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:
The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources. Substitute course information is available in the Registrar's office.

Assignments/Laboratory Work:
Home assignments are due one week after they are assigned. Late submissions will be penalized. Laboratory work is an important component of this course. Performing laboratory experiments will reinforce the concepts discussed in the theory class. If required, changes will be made. However, students will be notified prior to any changes.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.