

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, 2009 **PREVIOUS OUTLINE DATED:** June 2003

APPROVED:

Chair

DATE

TOTAL CREDITS: 5

PREREQUISITE: PHY 100

HOURS/WEEK: 4

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For additional information, please contact, Brian Punch, Chair

School of Natural Environment/Outdoor Studies & Technology Programs

(705) 759-2554, Ext. 2681

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 term 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 conservation 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
 - Compute 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.
 - 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, (2008), Applied Fluid Mechanics, Sixth Edition, Prentice-Hall
Verma, S. C. (2008), Hydraulics Course Manual, Environmental Training Services, PDF file in LMS

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	- 70%
Class Quizzes	- 30%

To pass the course a minimum of 50% score is required.

The following semester grades will be assigned to students in postsecondary courses:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
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)	<50%	0.00
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: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.

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.

Prior Learning Assessment:

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question. Please refer to the Student Academic Calendar of Events for the deadline date by which application must be made for advance standing.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio. Substitute course information is available in the Registrar's office.

Disability Services:

If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Disability Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

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*. A professor/instructor may assign a sanction as defined below, or make recommendations to the Academic Chair for disposition of the matter. The professor/instructor may (i) issue a verbal reprimand, (ii) make an assignment of a lower grade with explanation, (iii) require additional academic assignments and issue a lower grade upon completion to the maximum grade “C”, (iv) make an automatic assignment of a failing grade, (v) recommend to the Chair dismissal from the course with the assignment of a failing grade. 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.

Student Portal:

The Sault College portal allows you to view all your student information in one place. **mysaultcollege** gives you personalized access to online resources seven days a week from your home or school computer. Single log-in access allows you to see your personal and financial information, timetable, grades, records of achievement, unofficial transcript, and outstanding obligations, in addition to announcements, news, academic calendar of events, class cancellations, your learning management system (LMS), and much more. Go to <https://my.saultcollege.ca>.

Electronic Devices in the Classroom:

Students who wish to use electronic devices in the classroom will seek permission of the faculty member before proceeding to record instruction. With the exception of issues related to accommodations of disability, the decision to approve or refuse the request is the responsibility of the faculty member. Recorded classroom instruction will be used only for personal use and will not be used for any other purpose. Recorded classroom instruction will be destroyed at the end of the course. To ensure this, the student is required to return all copies of recorded material to the faculty member by the last day of class in the semester. Where the use of an electronic device has been approved, the student agrees that materials recorded are for his/her use only, are not for distribution, and are the sole property of the College.

Attendance:

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session. *It is the departmental policy that once the classroom door has enclosed, the learning process has begun. Late arrives will not be granted admission to the room.*

Tuition Default:

Students who have defaulted on the payment of tuition (tuition has not been paid in full, payments were not deferred or payment plan not honoured) as of the first week of <choose November, March, or June> will be removed from placement and clinical activities. This may result in loss of mandatory hours or incomplete course work. Sault College will not be responsible for incomplete hours or outcomes that are not achieved or any other academic requirement not met as of the result of tuition default. Students are encouraged to communicate with Financial Services with regard to the status of their tuition prior to this deadline to ensure that their financial status does not interfere with academic progress.