SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	HYDRAULICS		
CODE NO. :	WTR 330	**SEMESTER:**	III
PROGRAM:	Environmental-Water Engineering Technology		
AUTHOR:	*Subhash Verma, P.Eng*		
DATE:	May, 2010	**PREVIOUS OUTLINE DATED:**	June 2003
APPROVED:	"B. Punch"		
	Chair		**DATE**
TOTAL CREDITS:	5		
PREREQUISITE:	PHY 100		
HOURS/WEEK:	4		

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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, removed
   - 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 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

II. TOPICS:

1. Systems of Units
2. Fluid Properties
3. Fluid Statics
4. Fluid Kinematics
5. General Energy Equation
6. Flow Measurement
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 on 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%

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)	<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:

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.*