CAMOSUN COLLEGE
Trades & Technology
Mechanical Engineering

MEng132 Introduction to Fluid Mechanics
Winter 2018

COURSE OUTLINE

The calendar description is available on the web @ http://bit.ly/MEng132_Camosun

✴ *Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.*

1. Instructor Information

(a) Instructor	Katherina V. Tarnai-Lokhorst, P.Eng., FEC		
(b) Office hours	As posted		
(c) Location	Tec 115		
(d) Phone	email preferred	**Alternative:**	
(e) E-mail	lokhorst@camosun.bc.ca **ensure course name is in subject line of email*		
(f) Website	www.kathylokhorst.com		

2. Intended Learning Outcomes

(If any changes are made to this part, then the Approved Course Description must also be changed and sent through the approval process.)

Upon successful completion of this course a student will be able to:
• Calculate forces on flat and curved surfaces under pressure (submerged and pressurized).
• Calculate the center of pressure for a variety of submerged surfaces.
• Examine if an object will be buoyant and stable while floating using methods of buoyancy and metacentric height.
• Evaluate whether fluid flow will be laminar or turbulent using the Reynolds number (circular, non-circular, filled, non-filled flow conduits).
• Examine fluids from an energy perspective and develop the continuity equations (energy, momentum and Bernoulli's).
• Apply Bernoulli's equation to a wide variety of flow situations with a focus on gaining experience with series pipeline flow.
• Calculate friction losses in pipes and fittings using the Moody Diagram, Darcy's Equation and tabulated head loss values.
• As part of case study, design a series pipe line system.
• Describe a variety of flow and pressure measurement methods.
• Calculate the forces in piping arrangements (elbows, etc.) due to static and inertial forces.
• Calculate drag and lift forces on submerged bodies.
• Examine similitude and predict the flow conditions necessary to properly establish flow conditions for objects of differing scales.

3. Required Materials

(a) Texts

Applied Fluid Mechanics, 6th Ed., R.L. Mott (Required)

(b) Other

Course Notes Engr177, 2011, Z. Broom, P. Fell, S. Ferguson (available in D2L)

4. Course Content and Schedule

Out-of class expectations:

Common practice at Camosun College is to anticipate 2-3 hours out-of-class time for each hour spent in class. The student is encouraged to monitor their time accordingly.

Some techniques to assist with managing workload are:

- Scan recommended readings prior to attending class.
- Focus on introduction and conclusions, if short of time
- Create templates for reports and lab calculations
- Bring a laptop to classes and labs
- Attempt assignments as soon as they are presented

Course Schedule

Week	Lecture Week	Lecture Topic	Lab Schedule
1	Jan 8	Course overview; introduction to fluid mechanics; review of fluid pressure and measurement; fluid characteristics, definitions, properties and units; manometers, barometers, gauges, transducers. Ch. 1, 2	Tutorial: setting of lab teams
2	Jan 15	Fluid pressure and measurement, capillary action and surface tension; pressure concepts review (atmospheric, absolute and gauge pressure). Forces on submerged objects, planes and areas. Ch. 3, 4	Tutorial: practical applications & lab prep
3	Jan 22		Lab 1: Forces on submerged areas
4	Jan 29	Buoyancy and stability: forces on non-vertical planes and curved areas, forces on submerged and floating objects; stability of floating and submerged bodies, centers of gravity and buoyancy, metacentric height, degree of stability and static stability curves. Ch. 5	Lab 2: Metacentric Height
5	Feb 5	MID-TERM EXAM 1	No lab
6	Feb 12	No lecture or lab (Family Day & reading week)	Lab prep
7	Feb 19	Flow of fluids flow rates and the continuity equation; conservation of energy, ideal flow, Bernoulli's Equation; grade lines (energy line, hydraulic grade line. The	Lab 3: Application of Bernoulli's Theorem
8	Feb 26	General Energy Equation General Energy Equation and applications; Power (Pumps and fluid motors); friction loss. Ch. 6, 7	Tutorial: practical applications; lab prep
9	March 5	Laminar and turbulent flow, Reynold's number, velocity profiles, design velocities and flow rates. Friction loss equations, Darcy's Equation, Hagen-Poiseuille Equation, friction factors; relative roughness; Moody Diagram. Non-circular sections (Hydraulic Radius, Reynold's Number). Ch. 8, 9	Lab 4: Laminar and Turbulent Flow
10	March 12	Series pipe systems. Ch. 10	Tutorial: practical applications; lab prep

11	March 19	Lift & drag forces on submerged surfaces, pressure drag, friction drag, induced drag, compressibility effects. Ch. 17	Lab 5: Pipe and Fitting Losses
12	March 26	Flow in non-circular sections, air ducts. Ch. 18,19	Tutorial: practical applications
13	April 2	No lecture (Easter Monday). Lab classes continue	Lab 6: Lift & Drag
14	April 9	Wrap up of final topics, review.	Tutorial: practical applications
15	April 16 – 24	Final Exam (exam week)	

Note: this schedule is subject to change

5. Basis of Student Assessment (Weighting)

Labs	20%
Assignments	15%
Participation	5%
Midterm	25%
Final Exam	35%

Note:
- The final exam must be successfully completed (mark≥50%) for a passing grade in the course.
- All discussion questions, assignments and labs must be completed in order to write the final exam.
- Late assignments are not marked but are required for completion grading.

6. Grading System

(If any changes are made to this part, then the Approved Course description must also be changed and sent through the approval process.)
(Mark with "X" in box below to show appropriate approved grading system – see last page of this template.)

☑ Standard Grading System (GPA)

☐ Competency Based Grading System

7. Recommended Materials to Assist Students to Succeed Throughout the Course

Communication through Piazza.com. Please register for the course page at:
piazza.com/camosun.ca/winter2018/meng132

8. College Supports, Services and Policies

Immediate, Urgent, or Emergency Support
If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ http://camosun.ca/about/mental-health/emergency.html or http://camosun.ca/services/sexual-violence/get-support.html#urgent

College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at http://camosun.ca/

College Policies
Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at http://camosun.ca/about/policies/. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS http://camosun.ca/about/policies/

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at http://camosun.ca/about/policies/ for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	*Incomplete*: A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	*In progress*: A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	*Compulsory Withdrawal*: A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

MENG 132 – INTRODUCTION TO FLUID MECHANICS

Instructor Contact Information

NAME:	KATHY TARNAI-LOKHORST, P.ENG., FEC
OFFICE	TEC 115
HOURS:	AS POSTED
EMAIL:	LOKHORST@CAMOSUN.CA
COMMUNICATION:	PIAZZA.COM/CAMOSUN.CA/WINTER2018/MENG132/HOME This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Text & References

Applied Fluid Mechanics, 7th Ed., R.L. Mott (Required)

Course Notes Engr177, 2011, Z. Broom, P. Fell, S. Ferguson (available in D2L)

Official Course Description

Students will explore fluid properties and fluid statics (forces on submerged planes, pressure vessels, buoyancy). Fluid dynamic theory will be examined including: laminar and turbulent flows, energy continuity and momentum equations, fluid flow measurement, friction losses, and the design of piping systems. Other topics such as forces on piping systems, aerodynamic lift and drag, and similitude will also be covered.

Topic List *(subject to modification, as required)*

1. **Review of Introduction to Fluid Mechanics:** Definition of a fluid, fluid properties, pressure measurement, and manometers. *[Tutorial1: setting up lab groups & developing teams]*
2. **Forces on Submerged Areas:** Analysis of the static pressure forces due to submergence in a fluid. *[Lab1: Forces on Submerged Areas]*
3. **Buoyancy and Stability:** Buoyant forces, stability of craft in a fluid. *[Lab2: Metacentric Height]*
4. **Flow of Fluids:** Continuity, the energy-balance and Bernoulli's equation, pipes and design flow rates. *[Lab3: Laminar and Turbulent Flow]*
5. **The General Energy Balance Equation:** Energy losses and additions, pumps and motors, laminar and turbulent flows, Reynolds number. *[Lab4: Application of Bernoulli's Theorem]*
6. **Energy Losses due to Friction:** Darcy's equation, losses in laminar and turbulent flow, pipe roughness and the Moody diagram. *[Lab5: Viscosity – Falling Ball Viscometer]*

7. **Minor Losses:** Losses due to exits, enlargements, entrances, etc., valve and fitting losses, equivalent length. *[Lab6: Pipe & Fitting Losses]*
8. **Series Pipe Flow:** Class I systems and their analysis using the general energy balance.
9. **Lift & Drag:** Aerodynamic forces on submerged bodies. *[Lab7: Playing with Aerodynamics]*
10. **Non-standard Flow Conditions:** Examinations of flow through various cross-sections and scenarios.

Evaluation

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73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D	Minimum level of achievement for which credit is granted; a course with a "D" grade cannot be used as a prerequisite.	1
0-49	F	Minimum level has not been achieved.	0

Student Conduct

Camosun College has a student conduct policy:
http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf

Should any issues arise, regarding any concerns or an inability to meet the course requirements and expectations, contact the instructor immediately. We will make whatever arrangements possible to accommodate reasonable need.

Learning Support and Services for Students

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Student Services or the College web site at http://www.camosun.ca

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