MEng 132 – Introduction to Fluid Mechanics

Instructor Contact Information

Name:	Katherina Tarnai-Lokhorst, P.Eng., FEC, DSocSci
Office	Tec 115
Hours:	by arrangement
Email:	lokhorst@camosun.ca
Communication:	via email

I commit to answering emails within 2 business days (although I usually answer much quicker). Please take a picture of the work you have completed so far so that I can help you where you are. Also, checking questions over with your classmates/study groups prior to emailing me may help you find solutions quicker.

Text & References

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

Course Notes Engr177, 2011, Z. Broom, P. Fell, S. Ferguson (optional, and 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)* *[updated Jan12, 2018, with correct order of labs]*

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: Viscosity – Falling Ball Viscometer]*

5. **The General Energy Balance Equation:** Energy losses and additions, pumps and motors, laminar and turbulent flows, Reynolds number. *[Lab4: Laminar and Turbulent Flow]*

6. **Energy Losses due to Friction:** Darcy's equation, losses in laminar and turbulent flow, pipe roughness and the Moody diagram. *[Lab5: Application of Bernoulli's Theorem]*

7. **Minor Losses:** Losses due to exits, enlargements, entrances, etc., valve and fitting losses, equivalent length.

8. **Series Pipe Flow:** Class I systems and their analysis using the general energy balance. *[Lab6: Pipe & Fitting Losses]*

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

Labs	20%	Note: - The final exam must be successfully completed (mark≥50%) for a passing grade in the course.
Assignments	15%	
Participation	5%	- All discussion questions, assignments and labs must be completed in order to write the final exam.
Quizzes	25%	
Final Exam	35%	- Late assignments are not marked but are required for completion grading.

Lab Reports

Lab apparatus will be set up and available for student preview at least one week prior to the execution of the lab. Student lab groups will be responsible for preparing draft versions of both lab report and excel datasheet in advance of the lab execution date. These reports must include the standard sections and layout outlined in the content section in D2L. Excel and Word tutorials may be provided, as required.

Printed lab reports are due at the beginning of the following lab period or may be handed in online to D2L by 11:30pm as a single PDF document. Final reports should contain embedded tables and graphs unless these figures are large, in which case they should be included as appendices to the report. All figures and tables must be referenced in the prose of the document. References must be cited in-text where applicable and listed in the reference section, both using APA citation format (the textbook and lab manual should always form part of the reference list).

Assignments

Assignments are to be hand-written on engineering paper or using tablet computers with pale grid background. Assignments must be handed in at the *beginning of class* OR *scanned and submitted electronically by 11:30pm* on the due date specified. Scanned assignments may Group work is encouraged without plagiarism. This will be discussed and clarified in class.

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

Course Schedule

Week	Week of	Lecture Topic	Lab Schedule
1	Jan 7	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	Setting of lab teams
2	Jan 14	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 QUIZ 1 *set first QUIZ during week 5*	Tutorial: practical applications lab prep
3	Jan 21		Lab 1: Forces on submerged areas
4	Jan 28	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 QUIZ 2 Flow of fluids flow rates and the continuity equation; conservation of energy, ideal flow, Bernoulli's Equation; grade lines (energy line, hydraulic grade line.	Lab prep
5	Feb 4		Lab 2: Metacentric Height
6	Feb 11		Lab 3: Viscosity
7	Feb 18	No lecture or lab (Family Day & reading week)	
8	Feb 25	The General Energy Equation General Energy Equation and applications; Power (Pumps and fluid motors); friction loss. Ch. 6, 7 QUIZ 3	Lab prep
9	March 4	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). Ch. 8, 9 Series pipe systems. Ch. 10	Lab 4: Laminar and Turbulent Flow Tutorial
10	March 11		Lab 5: Application of Bernoulli's Theorem practical applications; lab prep
11	March 18	QUIZ 4	Lab 6: Pipe and Fitting Losses
12	March 25	Lift & drag forces on submerged surfaces, pressure drag, friction drag, induced drag, compressibility effects. Ch. 17	Tutorial: practical applications; lab prep
13	April 2		Lab 7: Playing with Aerodynamics
14	April 9	Wrap up of final topics, review.	Tutorial: practical applications
15	April 15 – 25	Final Exam (date TBD)	

Note: this schedule is subject to modification

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.

Grading Systems

HTTP://CAMOSUN.CA/ABOUT/POLICIES/INDEX.HTML
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.

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/index.html 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.