

MENG 132 – Introduction to Fluid Mechanics Course Outline

Course: MENG 132 – Introduction to Fluid Mechanics
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Calendar 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.

Offered: Winter Semester
Credit: 3
In-class workload: 2 hours lecture, 2 hours
laboratory Out-of-class workload: 4 hours
Prerequisites: C in MENG 131
Only open to students in the Mechanical Engineering Technology program.

Intended Learning Outcomes

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.

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Textbook

Applied Fluid Mechanics, 7th Ed., R.L. Mott (Required). This edition is recommended, but previous versions of the textbook will also suffice for the course.

This course is fully supported by D2L ©.

Evaluation

Assignments	15%
Labs (attendance, lab logbook, lab report)	15%
Quizzes	10%
Midterm Exam	25%
Final Exam	35%

All tests (Quizzes, Midterm Exam and Final Exam) in this course will be closed-book tests.

Lab work and Assignments are to be handed in when due and must be completed to the instructor's satisfaction prior to sitting the final exam.

The final exam must be successfully completed (mark $\geq 50\%$) for a passing grade in the course.

Laboratory Reports

Lab	Lab Title	Tentative Date
Lab 1	Fluid Properties	
Lab 2	Submerged Forces	
Lab 3	Metacentric Height	
Lab 4	Bernoulli Equation	
Lab 5	Laminar & Turbulent Flow	
Lab 6	Pipe Energy Losses	
Lab 7	Introduction to Aerodynamics	Optional

Formal laboratory reports are expected for each lab. The reports are due one week after the lab period. There will be one lab report for each group. No late laboratory reports will be accepted.

Assignments

Assignments are to be handed in when due. No late assignments will be accepted.

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Course Content and Schedule (subject to modification, if necessary)

Wk	Date	Course Content	Asst.	Qz.	Lab
1	Jan.07 Jan.08	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	Asst.1 (Ch1 - 3)	-	-
2	Jan.14 Jan.15	Fluid pressure and measurement, capillary action and surface tension; pressure concepts review (atmospheric, absolute and gauge pressure). Ch. 3	-	Qz.1	Lab 1
3	Jan.21 Jan.22	Forces on submerged objects, planes and areas. Ch. 4	Asst.2 (Ch4, 5)		Lab 2
4	Jan.28 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.	-	Qz. 2	Lab 3
5	Feb.04 Feb.05	Flow of fluids flow rates and the continuity equation; conservation of energy, ideal flow, Bernoulli's Equation; grade lines (energy line, hydraulic grade line. Ch. 6	Asst.3 (Ch.6)	-	Lab 4
6	Feb.11 Feb.12	The General Energy Equation General Energy Equation and applications; Power (Pumps and fluid motors); friction loss. Ch. 7 Midterm Review	Asst.4 (Ch.7)	Qz.3	-
7	Feb.18 Feb.19	No Class	-	-	-

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Wk	Date	Course Content	Asst.	Qz.	Lab
8	Feb.25 Feb.26	Midterm Exam (2 hrs)	-	-	-
9	Mar.03 Mar.04	Reynold's number, Laminar and turbulent flow, and Energy Losses due to Friction. Ch. 8	Asst.5 (Ch.8, 9)		Lab 5
10	Mar.10 Mar.11	Velocity profiles, design velocities and flow rates. Friction loss equations, Darcy's Equation, Hagen-Poiseuille Equation, friction factors; relative roughness; Moody Diagram. Noncircular sections (Hydraulic Radius). Ch. 9	-	-	-
11	Mar.17 Mar.18	Minor Losses Ch. 10 Series Pipeline Systems Ch.11	Asst.6 (Ch.10)	Qz.4	Lab 6
12	Mar.24 Mar.25	Pump Selection and Application Ch.13	-	-	-
13	Mar.31 Apr.01	Lift & drag forces on submerged surfaces, pressure drag, friction drag, induced drag, compressibility effects. Ch. 17	-	-	Lab 7
14	Apr.07 Apr.08	Final Review	-	-	-
15	Apr. 14 - 22	Final Exam	-		-

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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/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

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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/index.html> for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> 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	<i>In progress:</i> 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	<i>Compulsory Withdrawal:</i> 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.