Course: ENGR 292 Fluids & Thermodynamics, 2020
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Textbook

No textbook is required for ENGR 292; handouts are provided on D2L.

Calendar Description

In this course, the topics covered include: fluid properties, equations of state, pressure, buoyancy, hydrostatic forces, pressure measurement, conservation of mass, momentum, and energy; Bernoulli's equation, dimensional analysis, modeling; turbulent flow in pipes; turbo-machinery; conduction and convection. The following principles of mathematics are applied: partial and directional derivatives; maxima and minima; Lagrange multipliers and second derivative test; multiple integrals and applications.

Intended Learning Outcomes

Upon successful completion of this course a student will be able to:

- Calculate how pressure varies with depth in a stationary fluid.
- Calculate force and moment due to pressure on a submerged surface.
- Describe buoyant force and apply it for submerged and floating bodies.
- Explain why and when control volume analysis is used in fluids and thermodynamics.
- Identify an appropriate control volume.
- Apply control volume analysis of mass and momentum conservation to solve problems in steady and unsteady fluid mechanics and thermodynamics.
- Apply Bernoulli's equation.
- Explain the physical significance of each of the terms in the Navier-Stokes equations.
- Determine the non-dimensional parameters for a problem from a list of relevant dimensional parameters.
- Apply scaling to predict full-scale behavior from experimental data on a model.
- Describe the fundamental differences between laminar and turbulent flow.
- Use the Moody diagram to determine pressure loss in a fully-developed pipe flow.
- Account for minor losses in a pipe system.
- Determine a system curve for a pipe system.
- Use a pipe system curve and pump performance data to predict performance and select an appropriate pump.
- Define a thermodynamic system and its boundary interactions.
- Apply the First Law of Thermodynamics to both 'closed' and 'open' systems.
- Describe the implications of the Second Law of Thermodynamics and entropy generation.
- Calculate entropy change for 'open' and 'closed' systems.
- Perform a cycle analysis for ideal power generation and refrigeration cycles.

Course Content (NOTE: please read the relevant handouts *prior* to the weekly lecture periods)

Week	Assignments	Course Content
1	Read Handouts #1,2,3	*Fluid Mechanics* – Fluid properties, shear forces, viscosity, compressibility, pressure, buoyancy.
2	Read Handouts #4,5,6	*Fluid Mechanics* – Control volumes, conservation of mass, the balance of linear momentum.
3	**Assign. 1**	*Fluid Mechanics* – The Navier-Stokes equations, balance of angular momentum, conservation of energy, Bernoulli's equation.
4	Read Handout #7	*Fluid Mechanics* – Functions, dimensional analysis, the Buckingham Pi theorem, system scaling and experimentation.
5	Read Handout #8 **Assign. 2**	*Fluid Mechanics* – Laminar and turbulent flow, the Moody diagram, friction and minor losses in a piping system.
6	-	*Fluid Mechanics* – Piping system curves, pump performance curves and pump selection, NPSH.
7	-	***READING BREAK***
8	**Assign. 3**	Review/catch up, **TERM Exam 1.**
9	Read Handouts #9,10	*Thermodynamics* – Thermodynamic systems, open and closed systems, the 1st Law of thermodynamics, the ideal gas law.
10	Read Handouts #11,12	*Thermodynamics* – The 2nd Law of thermodynamics, the Clausius inequality, entropy, entropy production.
11	Read Handouts #13,14,15	*Thermodynamics* – Examples using entropy and the 2nd Law, air standard analysis, air power cycles.
12	Read Handout #16 **Assign. 4**	*Thermodynamics* – Vapor power cycles, thermodynamic efficiency, the ideal Rankine cycle.
13	Read Handout #17	*Thermodynamics* – Ideal refrigeration cycles, coefficients of performance, heat transfer, conduction, convection.
14	**Assign. 5**	*Thermodynamics* – Review/catch up period, **TERM Exam 2.**

Evaluation & Grading

Assignment problems will be graded based on completion, with solutions posted on D2L after the assignment is due. Assignments are due by 5:30 on the Friday of the weeks indicated in the above table, and **no late assignments will be accepted for grading**. See http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf for the Camosun grading policies.

Assignments	20%
Term Exam 1	40% (closed book)
Term Exam 2	40% (closed book)

→ *You must pass both term exams to pass ENGR 292*

College Supports, Services & 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 can be found at 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.