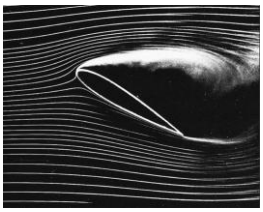
Course Outline: MECH 345 Mechanics of Fluids I- Spring 2012



Course Web Info: http://moodle.uvic.ca is the primary course info site
http://www.engr.uvic.ca/~rustomb/teaching/index.html
has this outline page only

Instructor: Rustom Bhiladvala rustomb@uvic.ca
Office Location: EOW 521 *Phone:* 721-8616
Office Hours: T 4-5 pm; email for other times.

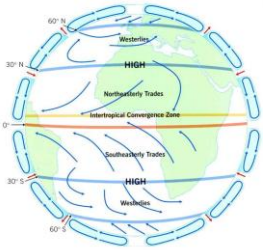
Lecture Times: Mondays & Thursdays 10:00-11:20
Lecture Location: ECS 116

Tutorial Time: Wednesdays 12:30-13:20
Tutorial Location: ECS 116

Lab Times:	Section B01	Mondays	13:30-16:30
	Section B02	Wednesdays	13:30-16:30
Lab Location:	ELW A140		

Teaching Assistants:

				Local
Expt. 1	Victor Keller	kellerv@uvic.ca	ELW_B260	4214
Expt. 2	Behnam Rahimi	behnamr@uvic.ca	EOW_227	8699
Expt. 3	Majid Soleimanini	majids@uvic.ca	ELW_A248	3182
Expt. 4	Jonathan Reaume	reaumejd@uvic.ca	ELW_A248	3182
Expt. 5	Ali Etrati	etrati@uvic.ca	ELW_A254	3180



Textbook: YA Cengel, JM Cimbala. Fluid Mechanics. 2nd edition, McGraw Hill.
Reference: FM White, Fluid Mechanics, 6th edition, McGraw Hill.

Prerequisite: Math 200, Calculus of Several Variables

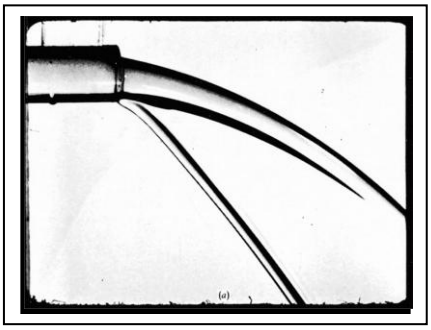
Course Description:

Properties of fluids. Basic flow analysis techniques. Basic concepts: velocity field, stress, flow patterns, classification of fluid motion. Fluid statics: pressure distributions, hydrostatic forces on submerged surfaces, buoyancy and stability. Integral analysis of fluid motion: conservation of mass, momentum balance, energy balance. Dimensional Analysis. Introduction to differential analysis of fluid motion. Internal flow in pipes and pipe systems. External flow past immersed bodies.

Labs:

There are five laboratory exercises for this course. Lab information is posted on the moodle course site. Laboratory report requirements, background and a lab schedule will be made available in the second week of term. During the lab period, students will work in groups of five (lab sections coordinated with other core courses, Theory of Mechanisms MECH 335, Mechanics of Solids MECH 320 and Energy Conversion MECH390).

Experiment #1 – Centre of Pressure and Hydrostatic Force on a Submerged Body
(Hydrostatic Bench)



Experiment #2 – Linear Momentum Experiment
(Hydraulics Bench, Jet Deflection Apparatus)

Experiment #3 – The Energy Equation in a Venturi-Type Flow
(Hydraulics Bench, Venturi Apparatus)

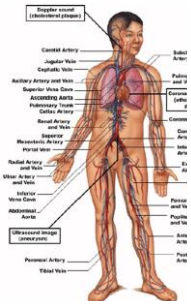
Experiment #4 – Friction in Laminar and Turbulent Pipe Flow
(Oil Pipe Flow Apparatus & Air Pipe flow Apparatus)

Experiment #5 – Lift & Drag on Airfoils

Evaluation:

Lab Work & Reports: (*15%*) Attendance, participation and report completion for all five laboratories are required to pass the course.

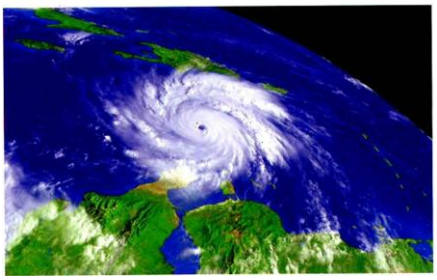
HW & HW_Quizzes: (*22%*) Weekly HW, including upto 2 HW_Quizzes (2% or less).

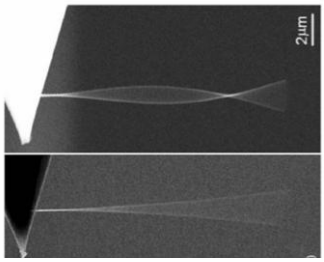


Class Participation: (*3%*) PreReq Quiz, Moodle-profile, I-Clicker responses in lecture. These help gauge understanding, and promote thinking and discussion. PreReq Quiz completion needed to earn any class participation marks. Wrong answers are not penalized for PreReq Quiz or I-Clickers.

Midterm Exam: (*20%*) Thursday 23rd February, 2012, 10:00-11:30 am.

Final Exam: (*40%*) Students must pass the final in order to pass the course.





SPR2012 MECH345: MECHANICS OF FLUIDS I

	M	Th	L#		Text: Ch-Secn
	Dates				
Jan					
		5	1	Fluids-liquids & gases.Using Fluid Mech. Thermofluids@UVic. Flow Classifications & Approximations.	1
	9		2	Properties & Behaviour: Density. Dyn & Kin Viscosity. Rheology. Vapour Pressure. SurfaceTension.	2
HW1		12	3	Problem solving: Applications of 1D Newtonian flows. Problems based on fluid properties.	2-7.*
	16		4	Hydrostatics: Pressure. Pasca'ls Law. Barometers, Manometers, Gauges. Newton's 2nd Law (fluid elem.)	3-1, 3-2, 3-3.
HW2		19	5	Hydrostatics: Standard Atmosphere. Buoyancy & Stability.	3-6. *
	23		6	Hydrostatics: Force on Submerged Plane Surfaces -Dams, Gates, Valves.	3-4.
HW3		26	7	Hydrostatics: Force on submerged curved surfaces. Rigid body motion.	3-5, 3-7.
	30		8	Elements of Flow Visualization. Reynolds Transport Theorem. Conservation of mass.	4-2,4-3,4-6,5-1,5-2.
Feb					
HW4		2	9	Integral Analysis. Reynolds Transport Theorem -CV Conservation of Linear Momentum. Examples.	6-1 to 6-4.
	6		10	Integral Analysis. Linear Momentum -Nozzles, Deflectors, Flanges, Estimating drag from velocity profiles.	6-4.
HW5		9	11	Integral Analysis. Bernoulli Equation -derivation; limitations of use. EGL/HGL and their use.	5-3, 5-4, 5-5.
	10			**Reading Break**	
		16		**Reading Break**	
	20		12	Applications of Bernoulli Equation -siphon, venturi, orifice, nozzle. Wind Turbines (Betz limit).	5-4, 6-4, 14-4(part)
		23	M	**Midterm -tests material till the 20th/HW5.**	
	27		13	Integral Analysis: Angular Momentum. Energy equation -systems with friction loss, pumps & turbines.	6-5, 6-6. 5-5, 5-6.
Mar					
HW6		1	14	Flow Kinematics. Eul/Lag. Material Deriv. Strain Rate tensor components.	4-1, 4-4, 4-5.
	5		15	Elements of Differential Methods: Mass, Mom, NS Eqns.	9-1 to 9-5 (Part).
HW7		8	16	Exact Solutions of NS -Couette, Pipe flow. Approx Soln Examples. Scope of CFD.	9-6 (Part).
	12		17	Dimensional Analysis:Pi Theorem. Expt Design -Geometic, Kinematic, Dynamic Similarity. Model Studies.	7-1 to 7-5. *
HW8		15	18	Non-Dim Param from Governing Eqns. Creeping Flow. Euler eqn. BL approx. BioFlows.	7-2. 10-1 to 10-4. *
	19		19	Internal Flow: Laminar & Turbulent flow -Reynolds number. Entrance Lengths. Non-circular ducts.	8-1 to 8-4.
HW9		22	20	Internal Flow: Reynolds' Averaging. Models. Mean velocity profile -inner, logarithmic, outer regions.	8-5. *

	26		21	Internal Flow: Friction Factor relations, Moody Chart. Major & Minor Losses. Pipe networks.		8-5 to 8-7.
H10		29	22	External Flow: Boundary Layer (BL) Approximation. BLs. Wind Tunnels. Pressure & Friction Drag.		10-6. 11-(1,2,3,5).
Apr	2		23	External Flow: Lift & Drag. Streamlined & bluff body flows. Airfoils. Applications.		11-3 to 11-7.
		5	24	External Flow. Some Fluid Mechanics film clips. Review for Final.		
				Text: Fluid Mechanics -Fundamentals & Applications. Y.A. Cengel & J.M. Cimbala.		
				* **Additional material from reference text: Fluid Mechanics. F.M. White.**		
				Additional material accessible from moodle include slides used in many of the classes, as well as links to		
				video clips exploring specific fluid phenomena (the NCFMF film serires).		