ENGG*2230 Fluid MECHANICS

SCHOOL OF ENGINEERING, UNIVERSITY OF GUELPH

FALL 2012

COURSE DESCRIPTION

Soil Mechanics is the branch of science that deals with the analysis of steady ideal and viscous fluid flow systems using the Continuity, Bernoulli and Momentum equations. Boundary layer theory is treated in terms of viscous and pressure drag, lift and its importance in heat and mass transfer. Dimensional analysis and dynamic similitude are studied to provide better understanding of flow analysis and modeling of both pipe flow as well as open channel flow systems.

INSTRUCTOR

Dr. Bahram Gharabaghi, THRN 2417, 519-824-4120 x 58451, bgharaba@uoguelph.ca
Homepage: http://www.soe.uoguelph.ca/faculty_pages/bahram_g.html

LABORATORY MANAGER

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TEACHING ASSISTANTS

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ENGINEERING PEER HELPERS

The peer helper program, staffed by upper year Engineering students, offers regular workshops aimed at developing problem solving skills and new learning tools specific to core engineering courses such as Fluid Mechanics. Contact the Peer Helper Program at engpeers@uoguelph.ca for more information.

COURSELINK

Please access course website to download course material and to upload laboratory experiment reports electronically to the course "Dropbox" under the designated folders: https://courselink.uoguelph.ca/shared/login/login.html

REQUIRED TEXTBOOK

F.M. White, 2010, Fluid Mechanics, 7th Edition, McGraw-Hill

COURSE RESOURCES

- **Lectures: Tues and Thur 04:00PM - 05:20PM, MACN, Room 113**

- **Laboratory Experiments (bi-weekly)**
  - Mon 01:30PM - 03:20PM, THRN, Room 1193;
  - Tues 01:00PM - 02:50PM, THRN, Room 1193;
  - Thur 09:30AM - 11:20AM, THRN, Room 1193;
  - Thur 01:00PM - 02:50PM, THRN, Room 1193;
  - Fri 02:30PM - 04:20PM, THRN, Room 1193.

- **Seminars (weekly)**
  - Mon 04:30PM - 05:20PM, MACK, Room 238;
  - Tues 10:00AM - 10:50AM, MACK, Room 238;
  - Wed 01:30PM - 02:20PM, MACK, Room 316;
  - Fri 01:30PM - 02:20PM, MACK, Room 232.

TOPICS OF STUDY

Week	Date	Lecture Topics
1	Sep. 10 to 14	Chapter 1: Introduction
2	Sep. 17 to 21	Chapter 2: Pressure Distribution in a Fluid
3	Sep. 24 to 28	Chapter 3: Integral Relations for a Control Volume
4	Oct. 1 to 5	Chapter 4: Differential Relations for Fluid Flow
5	Oct. 8 to 12	Chapter 5: Dimensional Analysis and Similarity
6	Oct. 15 to 19	Chapter 6: Viscous Flow in Ducts
7	Oct. 22 to 26	Chapter 7: Flow Past Immersed Bodies
8	OC. 29 to Nov. 2	Chapter 8: Computational Fluid Dynamics
9	Nov. 5 to 9	Chapter 9: Compressible Flow
10	Nov. 12 to 16	Chapter 10: Open-Channel Flow
11	Nov. 19 to 23	Chapter 11: Turbomachinery
12	Nov. 26 to 30	Review and Tutorial for the Final Exam

LABORATORY EXPERIMENTS

The laboratory experiments will be done in groups of three (3) students during your scheduled lab times. Sign-up sheets will be posted outside the Fluids Lab (THRN 1193) where you may choose your group with fellow students in the same scheduled lab time. Be sure to sign-up for a group by Friday Sep. 7th as labs begin Sep. 10th. Students in each group will collaborate in conducting the experiments, taking notes, and discussions; however, each student will write and submit a separate individual report.

There are 5 labs in total for the course according to the following schedule; If a student cannot attend a laboratory experiment on scheduled time for valid reasons, the student should contact the instructor and arrange to conduct the missed experiment during the Open Lab week.

Week	Date	Location: THRN 1193	Sections
1	Sep. 10 to 14	Lab 1: Flow Measurement	ENGG*2230*010X1 & 010X3
2	**Sep. 17 to 21**	**Lab 1: Flow Measurement**	**ENGG*2230*010X2 & 010X4**
3	Sep. 24 to 28	Lab 2: Pipe Friction	ENGG*2230*010X1 & 010X3
4	**Oct. 1 to 5**	**Lab 2: Pipe Friction**	**ENGG*2230*010X2 & 010X4**
5	Oct. 8 to 12	Open Lab / Demo	Open to All
6	**Oct. 15 to 19**	**Lab 3: Minor Losses**	**ENGG*2230*010X1 & 010X3**
7	Oct. 22 to 26	Lab 3: Minor Losses	ENGG*2230*010X2 & 010X4
8	**Oct 29 to Nov 2**	**Lab 4: Weir Flow**	**ENGG*2230*010X1 & 010X3**
9	Nov. 5 to 9	Lab 4: Weir Flow	ENGG*2230*010X2 & 010X4
10	**Nov. 12 to 16**	**Lab 5: Impact of a Jet**	**ENGG*2230*010X1 & 010X3**
11	Nov. 19 to 23	Lab 5: Impact of a Jet	ENGG*2230*010X2 & 010X4
12	**Nov. 26 to 30**	**Open Lab / Demo**	**Open to All**

Each student must prepare individually a technical report for each completed experiment ***due within one week of the date of the experiment*** and submit both electronically on the CourseLink “Dropbox” designated folder as well as in hard copy to the course instructor by the due date. Late submissions (without valid reasons approved by the instructor) will have a penalty of 25% per day.

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

1. Understand the basic concepts of Fluid Mechanics; articulate the unique properties that distinguish fluids from solids or granular materials.
2. Recognize various types of fluid flow problems encountered in practice and the broad range of engineering applications which involve fluid mechanics.
3. Model engineering problems and solve them in a systematic manner using basic software tools (especially spreadsheets) and mathematical models.
4. Have a working knowledge of accuracy, precision, and significant digits, and recognize the importance of dimensional homogeneity in engineering calculations.
5. Properly apply Newton's second law to analysis and design of engineering fluids systems using integral and differential calculus and control volume methods based on mass, momentum, and energy conservation laws, as appropriate.
6. Properly develop complex pipe network models and estimate flow, head and power requirements in these systems.
7. Apply basic principles of dimensional analysis and similitude to practical problems; properly interpret the Reynolds number and other key non-dimensional parameters.
8. Apply integral methods, and basic empirical and theoretical models, to the analysis of boundary layer flows, and to drag on bodies.
9. Apply fundamental knowledge of fluid mechanics to the analysis of specific sensors and instruments used in fluid-flow experiments.
10. Apply knowledge of Fluid Mechanics fundamentals combined with effective technical engineering problem solving skills to practical problems.
11. Follow laboratory testing procedures and standard methods, collect and analyze data and write professional engineering laboratory reports.
12. Demonstrate individual and team work ethics, professionalism and respectful interaction with both instructors and students during laboratory experiments.

SEMINARS AND QUIZZES

Quizzes are scheduled - as indicated in table bellow - during seminars; however, if a student cannot attend a quiz on scheduled time for valid reasons, the student should contact the instructor and arrange to write the quiz during the Open Quiz week.

Week	Date	Activity	Topics
1	Sep. 10 to 14	Seminar	Chapter 1
2	**Sep. 17 to 21**	**Seminar**	**Chapter 2**
3	Sep. 24 to 28	Seminar	Chapter 3
4	**Oct. 1 to 5**	**Quiz 1**	**Chapters 1, 2 & 3**
5	Oct. 8 to 12	Seminar	Chapters 4 & 5
6	**Oct. 15 to 19**	**Quiz 2**	**Chapters 4 & 5**
7	Oct. 22 to 26	Seminar	Chapters 5 & 6
8	**Oct. 29 to Nov. 2**	**Quiz 3**	**Chapters 5 & 6**
9	Nov. 5 to 9	Seminar	Chapters 7 & 8
10	**Nov. 12 to 16**	**Quiz 4**	**Chapters 7 & 8**
11	Nov. 19 to 23	Seminar	Chapters 9 & 10
12	**Nov. 26 to 30**	**Open Quiz**	**Chapters 9 & 10**

EVALUATION

The final grade will be determined from the results of the Laboratory Experiment Technical Reports, Quizzes, and the Final Examination weighted as follows:

1. Laboratory Experiment Technical Reports……..20%
2. Quizzes ……20%
3. Final Examination……60%

GRADE DISPUTES

If a student feels that a Quiz or Laboratory Report was graded unfairly, or if there is an error in the grading, it should be brought to the attention of the Instructor within one week after the graded material is handed back. Scores will not be reconsidered beyond one week after they are handed back.

POLICY FOR MISSED EXAMINATION

If the Final Examination is not written, the procedures in the current University of Guelph Undergraduate Calendar must be followed.

PLEASE NOTE

The regulations concerning Academic Misconduct as outlined in the current University of Guelph undergraduate calendar will be strictly enforced.