Applied Fluids and Thermodynamics (ENGG*3370)
Winter 2013 Course Outline

Instructor: Shohel Mahmud, Ph.D., P.Eng.
Assistant Professor
Room: 1410, Thornbrough Bldg
Tel: 519 824-4120 ext: 54058
Email: smahmud@uoguelph.ca

Teaching Assistants:

TA1: Tijo Joseph (tjoseph@uoguelph.ca)
TA2: Ronil Rabari (rrabari@uoguelph.ca)

Lectures and Exams:

Time: 4:00pm to 5:20pm (Tuesday and Thursday)
Room: MACK 029
Midterm Exam: 7:00pm to 9:00pm (Wednesday, 13th February, 2013, Room: MACK 029)
Final Exam: 2:30pm to 4:30pm (Tuesday, 16th April, 2013, Exam Room: TBA)

Course Textbook:

Applied Thermo-Fluids (A Custom Textbook designed for ENGG*3370 course and prepared for University of Guelph only) Publisher: McGraw-Hill, Canada.

(**Note**: Quiz, Midterm, and final are open book exams. Therefore, you need a copy of the course textbook for successfully complete these exams)

Additional References:

Thermodynamics: An Engineering Approach (7th Ed.), Y. Cengel, M. Boles, McGraw-Hill, 2011.
Refrigeration and Air Conditioning (3rd Ed.), C.P. Arora, McGraw-Hill, 2008.
Fluid Mechanics (7th Ed.), F.M. White, McGraw-Hill, 2011.
ASHRAE Handbook – Fundamentals (Chapters 17 and 21), American Society of Heating Refrigerating and Air-Conditioning Engineers, 2009.

Undergraduate Calendar Description

ENGG*3370 Applied Fluids and Thermodynamics W (3-2) [0.50]: This course builds on the fundamentals of fluid dynamics and thermodynamics introduced in previous courses by looking at relevant applications. Topics to be covered include: heating, ventilation and air conditioning (HVAC); heat engine systems such as the Carnot cycle for refrigeration and heat pumps and the Rankine cycle for vapour power systems; compressible flow, turbomachinery such as pumps, turbines, and propellers; and an introduction to combustion.
Prerequisite(s): ENGG*2230, ENGG*3260
Co-requisite(s): ENGG*3430

Tutorial and Quiz:

THRN 3402 (Sustainable Energy Lab) is booked for weekly tutorial. Each tutorial is 1 hour 50 minutes long. Your TA will solve and discuss a maximum of 2 problems in the first half of the tutorial (approximately 50 minutes – from Week 2 to Week 5). He will also answer your question regarding the "Problem Set" available in the course website. You are going to solve one or two problems in the next half of the tutorial (approximately 50 minutes – from Week 2 to Week 5) as a part of the tutorial quiz. You need to make a group of two students (including yourself) for solving the problem in the second part of the tutorial. At the end of each tutorial you must submit your solution to your TA for marking. You are heavily encouraged to attend the tutorial regularly.

Tutorial, Quiz, and Lab Experiments:

The purpose of performing the Lab is to verify some of the theoretical learning in our class by experiments. Applied Fluids and Thermodynamics Lab is located inside the "Sustainable Energy Lab (THRN 3402)". Lab experiments will be executed from Week 6 to Week 11. The class will be divided into two groups (maximum 15 students in each group). In the first hour, the first group will run the experiments and the second group will attend the tutorial and quiz (approximately 25 minutes for tutorial and 25 minutes for quiz). In the second hour, the second group will run the experiments and the first group will attend the tutorial and quiz (approximately 25 minutes for tutorial and 25 minutes for quiz). You need to make a team of five students (including yourself) for performing the experiment. You must submit the lab report to your TA one week after the lab is performed. 'Lab Manual' and schedule will be available in the COURSE LINK.

Week	Section 101 Tuesday (1:00pm to 2:50pm) THRN 3402	Section 102 Wednesday (3:30pm to 5:20pm) THRN 3402	Section 103 Friday (8:30am to 10:20am) THRN 3402
1 (7^{th} Jan – 11^{th} Jan)	No lab or tutorial in this week		
2 (14^{th} Jan – 18^{th} Jan) †	TA1	TA2	TA1
3 (21^{st} Jan – 25^{th} Jan) †	TA2	TA1	TA2
4 (28^{th} Jan – 1^{st} Feb) †	TA1	TA2	TA1
5 (4^{th} Feb – 8^{th} Feb) †	TA2	TA1	TA2
6 (11^{th} Feb – 15^{th} Feb)*	TA1 & TA2	TA1 & TA2	TA1 & TA2
18^{th} Feb – 22^{nd} Feb	Winter Break Week		
7 (25^{th} Feb – 1^{st} Mar) *	TA1 & TA2	TA1 & TA2	TA1 & TA2
8 (4^{th} Mar – 8^{th} Mar) *	TA1 & TA2	TA1 & TA2	TA1 & TA2
9 (11^{th} Mar – 15^{th} Mar) *	TA1 & TA2	TA1 & TA2	TA1 & TA2
10 (18^{th} Mar – 22^{nd} Mar) *	TA1 & TA2	TA1 & TA2	TA1 & TA2
11 (25^{th} Mar – 29^{th} Mar) *	TA1 & TA2	TA1 & TA2	TA1 & TA2
12 (1^{st} Apr – 5^{th} Apr)	TA1 & TA2	TA1 & TA2	TA1 & TA2

† Tutorial and quiz

* Lab experiment, tutorial, and quiz

Marking Scheme:

Tutorial Quiz	: 5%
Midterm Exam	: 35%
Lab Experiments	: 15%
Final Exam	: 45%

Course Outline for ENGG*3370 (Applied Fluids and Thermodynamics):

- Review of thermodynamics and fluid mechanics

- Advanced topics on vapor/combined power cycles (e.g., vapor power cycle with regeneration, co-generation, combined power cycle, and binary power cycle)
  - Lab: Power and efficiency calculation (Equipment: Mini steam power plant)

- Multistage refrigeration cycle, cascade refrigeration cycle, heat pumps, components, refrigerants, and special refrigeration processes
  - Lab: Cooling load and COP calculations (Equipment: Heat pump setup)
  - Lab: Special refrigeration system demo (Equipment: vortex tube and thermoelectric systems)

- Gas power cycles, internal combustion engines (reciprocating and rotary engines), Stirling engines
  - Lab: Stirling engine demonstration (Equipment: low ΔT Stirling engine, medium ΔT Stirling engine, and high ΔT Stirling engine)
- Compressible flow

- EXERGY: A measure of work potential, EXERGY analysis of systems, processes, and cycles
  - Lab: Exergy analysis of a body loosing heat (Equipment: hot water in a cup)
  - Lab: Exergy analysis of a moving body (Equipment: conservation of energy set up)

- Gas vapor mixture, Air-conditioning, cooling/heating load calculation, duct design
  - Lab: Analysis of different air-conditioning systems (Equipment: HVAC set up)
  - Lab: Demonstration of a window air-conditioner (Equipment: Window type air-conditioning unit)

- Chemical reaction and introduction to combustion
  - Lab: Calculation of heating values of solid and liquid fuels (Equipment: Bomb calorimeter)

- Introduction to Turbomachinary

- Hydraulic turbines: impulse and reaction turbines
  - Lab: Performance calculation of an impulse turbine (Equipment: Pelton Wheel)
  - Lab: Performance calculation of a reaction turbine (Equipment: Francis Turbine)

- Hydraulic pumps: rotadynamic and positive displacement pumps
  - Lab: Performance calculation of an rotadynamic pump (Equipment: Centrifugal pump)
  - Lab: Performance calculation of appositive displacement pump (Equipment: Reciprocating pump)

- Special topics on Applied Fluids and Thermodynamics