**University of British Columbia**
Department of Mechanical Engineering

# MECH 489: Experimental Thermofluids
# MECH 582: Experimental Fluid Mechanics
# 2015 Course Syllabus

**Lectures**: Monday, Wednesday, Friday: 2:00pm – 3:00pm, SWNG 409
**Lab**: October 14 – 23, room and times to be announced
November 2 – 13, room and times to be announced
November 23 – December 4, independent lab

## Instructor

Patrick Kirchen
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Office Hours: Thursdays 3pm-4pm

## Teaching Assistants

Amin Engarnevis
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Office Hours: During labs or by appointment

**COURSE MATERIALS AND IMPORTANT MESSAGES WILL BE POSTED ON CONNECT (connect.ubc.ca)**

## Course Description (UBC Calendar)

Experimental uncertainty. Design of experiments. Test facilities. Temperature and pressure measurement techniques and instrumentation. Velocity and flow rate measurement techniques. Flow visualization. Case studies of industrial and research experimental practice. Credit will not be given for both MECH 489 and MECH 582.
4 Credits: [3-2-0]
Prerequisite: All of MECH 375, MECH 380.

## Learning Objectives

Through this course, students will develop an understanding of – and be able to apply - tools and methods for experimental characterization of thermofluid systems. More specifically, students will:

- Become comfortable in the key aspects of experimental investigations, including:
  - Experiment design
  - Sensor and data acquisition system selection
  - Uncertainty analysis
  - Translation of measurements into useful engineering analysis

- Become aware of different instruments available for temperature, pressure, and flow characterization
- Be able to design and characterize a (theoretical) experimental system
- Prepare and communicate results clearly in written reports and presentations

# Evaluation Criteria

Students will be evaluated on their ability to:

- Design an experimental system for a given thermofluid system, including a justification based on engineering principles
- Quantify the uncertainty of an experimental system and place this in the context of an engineering system
- Demonstrate comprehension of the operating principles and applicability of various measurement tools

These evaluation criteria will be assessed through a series of examinations, lab exercises and reports, and a project with associated report and presentation.

# Grade Weighting

### Assignments

Several problem sets will be distributed, designed to give students an opportunity to practice the concepts presented in class and are representative of some of the exam questions. These assignments are optional (i.e. not for credit) but are **strongly recommended**.

### Labs (20%)

Three laboratory exercises will take place between October and December. You will need to schedule a time slot with the TA (a registration sheet will be distributed in class). For each experiment, students will perform the laboratory exercise and submit a lab report, within two weeks of the lab. The final laboratory exercise is to be done independently by students outside of a guided lab. Students registered in MECH 489 can complete the lab in groups of 3 and submit one report per group. Students enrolled in MECH 582 must complete the lab and reports individually.

### Project (30%)

Students will design an experiment for a thermofluid system (to be defined by the instructor). Students enrolled in MECH 489 can complete the projects in groups (2-3 students per group), while those enrolled in MECH 582 must complete the project individually. The final design and justification thereof is to be presented in a **written report (20%)** and an **in-class presentation (10%)**.

### Exams (50%)

There will be **one midterm examination (20%)** during the term (tentatively October 9th) and one **final examination (30%)** during the regular final examination period (date TBA).

**To pass MECH 489/582 a minimum overall average of 50% and a score ≥50% on the final exam is required.**

# Textbook

Experimental Methods for Engineers. J. P. Holman. 8th edition. McGraw Hill, 2012.
*Available in the UBC bookstore.*

## Plagiarism and Misconduct

All suspected instances of plagiarism, cheating or misconduct will be treated as outlined in the official University of British Columbia policy (see link below) and will be noted on your departmental student file. The consequences of academic misconduct can range from a grade of zero on the work in question, to expulsion from your program. It is your responsibility to read, understand and abide by these regulations.

http://vpacademic.ubc.ca/integrity/ubc-regulation-on-plagiarism/

## Late Policy

The following penalties will apply to late submissions: -15% if received by the end of the day after it was due, -25% if received two days after the due date, -50% if received three days after the due date. Submissions received four or more days after due date will not be graded. Late lab reports or projects will be excused, or extensions granted for special circumstances (medical reasons, emergencies, etc.) if requested well in advance of the due date, when appropriate.

## Lectures, Readings, and Tutorials

The table below provides the approximate lecture schedule for this term. Note that this may change throughout the course of the term. The assigned readings correspond to chapters the 8th edition of the Holman textbook.

| Week | Topic | Reading |
|---|---|---|
| 1 | Introduction | 1 |
| 2 | Experimental design, static vs. dynamic measurements | 2 |
| 3 | Uncertainty and data analysis | 3.1-3.9 |
| 4-5 | Data acquisition systems | 4.1-4.16, 14.1-14.6 |
| 6 | Pressure measurement | 6.1-6.6 |
| 7 | Flow measurement and visualization | 7.1-7.15 |
| 8-9 | Temperature measurement | 8, 9.1-9.3, 9.9 |
| 10 | Gas composition, “Best practices” | Class notes |
| 11 | Case studies | Class notes |
| 12 | Project presentations | |
| 13 | Project presentations; review for final | |