Aim: To understand and be able to apply the basic principles of thermodynamics, fluid mechanics and heat transfer.

Lecturers: Dr Rajnish Sharma (course organiser) Room 1.1005 r.sharma@auckland.ac.nz
           Prof Richard Flay Room 1.906 r.flay@auckland.ac.nz
           Assoc Prof Joe Deans Room 1.905 j.deans@auckland.ac.nz

Tutors: Dr Rajnish Sharma (RS) Prof Richard Flay (RF) Assoc Prof Joe Deans (JD)
         Assoc Prof Robert Raine (RR) Room 1.902 r.raine@auckland.ac.nz
         Mr Alexander Blakeley (AB) abla089@aucklanduni.ac.nz

Assessment: Final examination 60% + Coursework 39%. + Completion of online course survey 1%
In addition, you must obtain at least 40% in the final examination to pass.
Coursework is: 30% tests (3 tests x 10% each), and 9% labs (3 labs x 3% each).

Examination: Closed Book (and also for tests)

Timetable:
Lectures: Mondays 11 am MLT 1 (303-G23)
          Wednesdays 2 pm Lib B15 (109-B15)
          Thursdays 12 pm OGGB 3 (260-092)

Tutorials: Fridays 4pm

Labs: 3 labs, 5 sessions in each week as follows (refer SSO for your group and time):

Lab 1: Energy Balance & Heat Transfer  Wks 3, 4, 5  (Room 3.308)
Lab 2: Momentum of an Air Jet       Wks 7, 8, 9  (Room 3.209)
Lab 3: Flow Measurement             Wks 10, 11, 12 (Room 3.209)

YOU MUST ATTEND ALL 3 LABS AT THE TIMES ADVISED FOR YOUR GROUP. IF YOU MISS A LAB, YOU WILL NOT BE ALLOWED TO ATTEND ANOTHER SESSION, except under special circumstances. The first lab starts in week 3 and is in room 3.308.

Tests: There will be three 50-minute tests during the tutorial hour in Weeks 4, 8, and 12. Each test will cover only the material from the previous 3 weeks, and will be worth 10%.

Prescribed Textbook: Fundamentals of Thermal-Fluid Sciences 3rd Edn
By Y A Cengel, R H Turner & J M Cimbala, (McGraw Hill) - Available at both the UBS.

IMPORTANT: It will be difficult to pass this course unless you own this text!
**Philosophy:**

The emphasis in this paper is on

- basic principles and their application to simple, ideal and real systems; and
- integration of thermodynamics, fluids and heat transfer into useful systems.

**What you need to know:**

To pass this paper you need to learn to solve basic problems in thermodynamics, heat transfer and fluid dynamics. This means that you must be able to:

- understand all the definitions and the conservation laws (mass, momentum and energy)
- find properties of substances, and determine their phase
- recognise when you can make approximations
- decide correctly which equations apply to particular processes
- describe your solutions clearly and unambiguously.

**Note:** This paper introduces many new concepts which you must understand, so the material does not lend itself to last-minute cramming for exams. Therefore, you are expected to:

1. Attend the tutorials; and
2. Devote at least 6 hours to this course each week, in addition to the 4 contact hours. You may spend such time towards reading material and examples from the text and then attempting problems from tutorial sheets and the text.

**Outline:**

**Thermodynamics [ JD ] (Weeks 1 - 4) Ch 1 – 6 Cengel, Turner & Cimbala**

1. Introduction and Overview
2. Basic Concepts of Thermodynamics
3. Properties of Pure Substances
4. Energy Transfer by Heat, Work and Mass
5. The First Law of Thermodynamics

**Fluid Mechanics [ RGF ] (Weeks 5 - 8) Ch 9-15 Cengel, Turner & Cimbala**

6. Basic Concepts of Fluid Mechanics
7. Fluid Statics
8. Bernoulli, Energy and Momentum Equations
9. Flow in Pipes
10. Flow over Bodies: Drag and Lift

**Heat Transfer [ RNS ] (Weeks 9 - 12) Ch 16, 17, 19, 22 Cengel, Turner & Cimbala**

11. Mechanisms of Heat Transfer
12. Conduction
13. Convection
14. Heat Exchangers

**Handouts:**

**Lectures:**

During each lecture week, you will be provided with a 1 to 2 page handout containing keywords and textbook section numbers for your reading. Lecture notes containing blanked-out sections will be posted on Cecil that you may print for use during lectures. Where possible, powerpoint presentations will be made available via Cecil.

**Tutorials:**

A tutorial sheet will be handed out each week and uploaded onto Cecil as well.

**Laboratories:**

Lab handouts will be made available from weeks 3, 7, and 9 for the 3 labs respectively; and uploaded onto Cecil as well.