



UNICV

Source Outline

Semester 1, 2015



**MECH9620**

**COMPUTATIONAL FLUID  
DYNAMICS**





## COURSE OUTLINE

### 1. STAFF CONTACT DETAILS

#### Course Lecturers

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\*Course convenor

### 2. COURSE DETAILS

#### Units of credit

This is a 6 unit-8n5 TJBDC Bo1 0 0 1 107.66 534.31 Tm0 0 1 rg0 0JE1nJBT1 0 0 1 94.344 548.11

## Summary of the course

This course introduces the student to the terminology, principles and methods of CFD Computational Fluid Dynamics.

CFD can be used in many areas of engineering, including aerodynamics, hydrodynamics, air-conditioning and minerals processing and you will find relevance to many other courses you are currently taking.

## Aims of the course

The aims of the course are to:

- Place CFD in the context of a useful design tool for industry and a vital research tool for thermo-fluid research across many disciplines. To develop understanding of the conservation laws applied to fluid motion and heat transfer. Familiarise students with basic computational methods including explicit, implicit methods, discretization schemes and stability analysis.
- Familiarise students with the basic steps and terminology associated with CFD.
- To develop practical expertise of solving CFD problems with a commercial CFD code, ANSYS CFX.
- To develop an awareness of the power and of limitations of CFD.

This course builds on knowledge you have gained in other courses such as Fluid Mechanics, Thermodynamics and Numerical Methods.

## Student learning outcomes

- An underlying understanding of the theoretical basis of Computational Fluid Dynamics (CFD).
- The ability to develop CFD models for engineering problems.
- The technical ability to address complex problems using CFD; specifically with practical skills in using a commercial CFD package, ANSYS CFX.

d) able to apply their knowledge and skills to solving problems (\*)

Effective learning is supported when you are actively engaged in the learning process and by a climate of enquiry, and these are both an integral part of the lectures and laboratory sessions.

You become more engaged in the learning process if you can see the relevance of your studies to professional, disciplinary and/or personal contexts, and the relevance is shown in the lectures and assignments by way of examples drawn from industry.

Dialogue is encouraged between you, others in the class and the lecturers. Diversity of experiences is acknowledged, as some students in each class have prior CFD experience. Your experiences are drawn on to illustrate various aspects, and this helps to increase motivation and engagement.

It is expected that minor assignments will be marked and handed back in the week following submission. You will have feedback and discussion while fresh in your mind to improve the learning experience. The major assignment may take two weeks to mark.

#### **4. TEACHING STRATEGIES**

Lectures in the course are designed to cover the terminology and core concepts and theories in CFD. They do not simply reiterate the texts, but build on the lecture topics using examples taken directly from industry to show how the theory is applied in practice and the details of when, where and how it should be applied.

Tutorials are designed to provide you with feedback and discussion on the assignments, and to investigate problem areas in greater depth to ensure that you understand the application and can avoid making the same mistake again.

#### **5. ASSESSMENT**

##### **General**

to that project if you wish. Otherwise, choose something you are interested in or you style problem, flow around an aircraft wing, racing car exhaust, wind study around a building, flow in an artery, etc.).

The report you submit will be a technical report in the style of a journal article or industrial project report for a client familiar with CFD a template will be provided to you which will also contain a structured marking criteria: you will write and abstract/executive summary, and you will be required to conduct a short review of some similar CFD you are able to find in relevant journal papers. Following this, you will write a discussion of your chosen numerical method and assumptions, and then sections relating to mesh convergence, turbulence modelling, and presentation of key results these reflect the topics which will be covered in depth in the lectures and tutorials and comprise the typical structure of a research report.

### Tutorial problems

The short assignments containing sets of tutorial problems (T1, T2, T3) are listed in page 10. They will involve theoretical work and calculations. Assignments will be available on the Moodle website.

### Presentation

A standard specification is available from the School office to aid presentation of your assignments (in all courses). All submissions should have a standard School cover sheet. All submissions are expected to be neat and clearly set out. All calculations should be shown as, in the event of incorrect answers, marks are awarded for method and understanding.

The preferred set-out of any numerical calculation is similar to the following:

$P_E = R_T V$	(Equation in symbols)
$= 203.7 \ 20.58$	(Numbers substituted)
$= 4192 \text{ kW}$	(Answer with units)

### Submission

The required submission dates are given on the assignment sheets themselves and also in page 10.

Late submissions attract a penalty of ten percent per *day*, unless prior dispensation has been given; i.e. see the lecturer before the due date to avoid penalty. It is always worth submitting assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

### Criteria

The following broad criteria will be used to grade assignments, while the major assignment will have more specific criteria incorporated into the report template when issued:

For report-style assignments the following criteria will be used:

Identification of key facts and the integration of those facts in a logical development.

Clarity of communication this includes development of a clear and orderly structure and the highlighting of core arguments.

Sentences in clear and plain English this includes correct grammar, spelling and punctuation.

Correct referencing in accordance with the prescribed citation and style guide.

All other assignments involve numerical calculations, for which the following criteria will be used:

Accuracy of numerical answers.

Use of diagrams, where appropriate, to support or illustrate the calculations.

Use of graphs, where appropriate, to support or illustrate the calculations.

Use of tables, where appropriate, to support or shorten the calculations.

Neatness.

## **Examination**

There will be a three-hour examination at the end of the session.

You will need to provide your own calculator, of a make and model approved by UNSW, for the examination. The list of approved calculators is shown at <https://student.unsw.edu.au/exam-approved-calculators-and-computers>

It is your responsibility to ensure that your calculator is of an approved make and Engineering Student Centre prior to the examination. Calculators not bearing an

## **Special Consideration and Supplementary Assessment**

For details of applying for special consideration and conditions for the award of supplementary assessment, see *Administrative Matters for All Courses*, available from the School website.

## **6. ACADEMIC HONESTY AND PLAGIARISM**

Plagiarism is using the words or ideas of others and presenting them as your own.

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a booklet which provides essential information for avoiding plagiarism:

<https://my.unsw.edu.au/student/academiclife/Plagiarism.pdf>



You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks. If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more

someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in a honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:

<http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf>

Further information on School policy and procedures in the event of plagiarism is presented in a School handout, Administrative Matters for All Courses, available on the School website.

**7.**



copies of assignments (as they are issued, in case you missed the hand-out in class);  
tutorial problems;  
discussion forum.  
links to any useful material discussed in class

The discussion forum is intended for you to use with other enrolled students. The course convenor and/or demonstrators will occasionally look at the forum, monitor any inappropriate content, and take note of any frequently-asked questions, but will only respond to questions on the forum at their discretion. If you want help from the convenor then direct contact is preferred.

## **9. COURSE EVALUATION AND DEVELOPMENT**

The course has been redesigned in 2015 and will be evaluated at the end of this semester. Feedback on the course is gathered periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) process, informal discussion in the final class for the course, a meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include a reduction in the amount of code-writing required and also the introduction of a major assignment with the topic of the student's choice.

## **10.**