School of Engineering

MECH3780: Fluid Mechanics 2 and CFD

Singapore PSB
Trimester 2 - 2024 (Singapore)

COURSE OUTLINE

OVERVIEW

Course Description

This course blends together physical and mathematical concepts in a more advanced treatment of fluid mechanics. Analytical methods introduced in earlier courses are extended to compressible flows, applications in fluid machines and turbulent flows and turbulence modelling. The latter is used as a basis to provide a practical introduction to Computational Fluid Dynamics (CFD).

Academic Progress Requirements

Nil

Assumed Knowledge

MATH2310 Calculus of Science and Engineering, ENGG2300 Engineering Fluid Mechanics (previously MECH2710).

Contact Hours

Singapore PSB

Computer Lab
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

Forum
Online
2 hour(s) per week(s) for 13 week(s) starting Week 1
Pre-recorded videos posted prior for any Forum session.

Lecture
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

Unit Weighting

10

Workload

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

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SYLLABUS

Course Content

1. Fluids Machinery
2. Compressible flows
3. Navier-Stokes equations and Reynolds stress equations
4. Turbulence and turbulent flows
5. Introduction to Computational Fluid Dynamics

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Discuss and solve compressible flows and apply fluid modelling concepts to practical engineering applications

2. Analyse and numerically model turbulence

3. Describe aspects of various turbulent flows (jets, wake, channel, and boundary layers)

4. Apply Computational Fluid Mechanics approaches to the analysis of complex fluid flows

5. Demonstrate an awareness of the limitations and assumptions involved in Computational Fluid Dynamics

6. Discuss the value of validation procedures for Computational Fluid Dynamics

Course Materials

Lecture notes: will be uploaded on Canvas.

Book: White Frank, Fluid Mechanics, 4th or 5th or 9th edition (the latest is good) or E-book.

ASSESSMENTS

This course has 4 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Assignment 1	Week 4	Individual	15%	1, 2, 3, 4
2	Quiz 1	Week 7	Individual	25%	1, 2, 3
3	Quiz 2	Week 13	Individual	25%	2, 3, 4, 5, 6
4	Engineering Report	Week 13	Individual	35%	1, 2, 3, 4, 5, 6

Late Submissions

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Assignment 1

Assessment Type	Written Assignment
Purpose	1 - To provide the students with the opportunity to show that they have understood the concepts learned in class and acquired the skills to solve problems in applying these concepts. 2- To allow the lecturer to assess the progress of the students during the semester and identify those who might be needing help.
Description	To solve a set of problems
Weighting	15%
Length	60 minutes
Due Date	Week 4
Submission Method	In Class
Assessment Criteria	To be advised on Canvas
Return Method	Online
Feedback Provided	In Class
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Quiz 1

Assessment Type	Quiz
Purpose	1- To allow the students to self-assess their progress. 2- To allow the lecturer to assess the progress of the students, and, possibly, identify those who need special help.
Description	To solve a set of problems
Weighting	25%
Length	90 minutes
Due Date	Week 7
Submission Method	In Class
Assessment Criteria	To be advised on Canvas
Return Method	Online
Feedback Provided	In Class
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - Quiz 2

Assessment Type	Quiz
Purpose	1- To allow the students to self-assess their progress. 2- To allow the lecturer to assess the progress of the students, and, possibly, identify those who need special help.
Description	To solve a set of problems
Weighting	25%
Length	90 minutes
Due Date	Week 13
Submission Method	In Class
Assessment Criteria	To be advised on Canvas
Return Method	Online
Feedback Provided	In Class
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 4 - Engineering Report

Assessment Type	Report
Purpose	1- To allow the students to self-assess their progress. 2- To allow the lecturer to assess the progress of the students, and, possibly, identify those who need special help.
Description	To solve a set of problems
Weighting	35%
Length	120 minutes

Due Date	Week 13
Submission Method	In Class
Assessment Criteria	To be advised on Canvas
Return Method	Online
Feedback Provided	In Class
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances	The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where: 1. the assessment item is a major assessment item; or 2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system; 3. you are requesting a change of placement; or 4. the course has a compulsory attendance requirement. Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at: https://policies.newcastle.edu.au/document/view-current.php?id=236.
Important Policy Information	The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability		X		3
12	3.2. Effective oral and written communication in professional and lay domains.		X	X	3
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.		X		3
15	3.5. Orderly management of self, and professional conduct.		X		3
16	3.6. Effective team membership and team leadership.		X		3
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	X	X	X	3
8	2.2. Fluent application of engineering techniques, tools and resources.	X	X	X	3
9	2.3. Application of systematic engineering synthesis and design processes.	X	X		3
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	X	X	X	3
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	X	X	X	3
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	X	X	X	3
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.				
5	1.5. Knowledge of contextual factors impacting the engineering discipline.	X	X		3
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				

This course outline was approved by the Head of School on 4th April, 2024. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.
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