UNSW Course Outline

MATS2005 Introduction to Fluid Flow and Heat Transfer - 2024

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General Course Information

Course Code : MATS2005
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Materials Science & Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course introduces the fundamentals of fluid flow and heat transfer, and their applications in materials engineering. The fluid flow section starts with the concepts of fluids and static fluids, followed by the description of various fluid flows and their governing equations. Finally, the

principle and applications of Bernoulli's equation are discussed. The heat transfer section introduces the mechanisms, governing equations and applications of conductive heat transfer, convective heat transfer and thermal radiation. The course includes face-to-face lectures, in-class quizzes and weekly tutorials.

Course Aims

This course introduces the basic concepts in fluid flows and heat transfer and their applications in materials engineering. The aim is to equip students with the knowledge to understand the principles and mechanisms of fluid flow and heat transfer related problems in materials engineering and the skill to solve the problems.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Explain the phenomena relating to fluid flows and heat transfer and the underlying mechanisms.
CLO2 : Apply governing equations to solve fluid flow and heat transfer related questions.
CLO3 : Analyse fluid flow and heat transfer phenomena in materials engineering in order to generate solutions.
CLO4 : Communicate effectively to explain fluid flow and heat transfer phenomena and present solutions in written format.

Course Learning Outcomes	Assessment Item
CLO1 : Explain the phenomena relating to fluid flows and heat transfer and the underlying mechanisms.	• In-Class Quiz • Two Assignments • Mid-Term Test • Final Exam
CLO2 : Apply governing equations to solve fluid flow and heat transfer related questions.	• In-Class Quiz • Two Assignments • Mid-Term Test • Final Exam
CLO3 : Analyse fluid flow and heat transfer phenomena in materials engineering in order to generate solutions.	• Two Assignments • Mid-Term Test • Final Exam
CLO4 : Communicate effectively to explain fluid flow and heat transfer phenomena and present solutions in written format.	• Two Assignments

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
In-Class Quiz Assessment Format: Individual	10%	Start Date: Weeks 2, 4, 8 and 10 Due Date: Week 2: 03 June - 09 June, Week 4: 17 June - 23 June, Week 8: 15 July - 21 July, Week 10: 29 July - 04 August
Two Assignments Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Week 5: 24 June - 30 June, Week 10: 29 July - 04 August
Mid-Term Test Assessment Format: Individual	35%	Start Date: week 5 Due Date: Week 5: 24 June - 30 June
Final Exam Assessment Format: Individual	35%	Start Date: Final exam period Due Date: Final exam period

Assessment Details

In-Class Quiz

Assessment Overview

Four in-class tutorial exercises (equally weighted) will be conducted in weeks 2, 4, 8 and 10.

The 60-minute, open-book tasks include both short answers and multiple-choice questions, aiming to assess your understanding of the topics covered since the previous exercise.

The solutions will be provided immediately after the exercises, and the marks will be available within a week of the test.

Course Learning Outcomes

- CLO1 : Explain the phenomena relating to fluid flows and heat transfer and the underlying mechanisms.
- CLO2 : Apply governing equations to solve fluid flow and heat transfer related questions.

Assessment Length

60-90 min

Assignment submission Turnitin type

Not Applicable

Two Assignments

Assessment Overview

Two individually completed assignments (each weighted 10%) will assess your ability to apply fundamental concepts and the governing equations to solving fluid flows and heat transfer related problems in materials processing.

The assignments will be distributed in weeks 2 and 7, with the submissions due in weeks 5 and 10, respectively.

The solutions of the assignments will be provided 1 week after submission and the marked assignments will be returned two weeks after submission.

Course Learning Outcomes

- CLO1 : Explain the phenomena relating to fluid flows and heat transfer and the underlying mechanisms.
- CLO2 : Apply governing equations to solve fluid flow and heat transfer related questions.
- CLO3 : Analyse fluid flow and heat transfer phenomena in materials engineering in order to generate solutions.
- CLO4 : Communicate effectively to explain fluid flow and heat transfer phenomena and present solutions in written format.

Assignment submission Turnitin type

Not Applicable

Mid-Term Test

Assessment Overview

The mid-term test will be conducted in week 5 to assess your knowledge on the topic of fluid flow.

The 100-min closed-book test includes both short-answer and calculation questions.

Solutions and marks will be available within 2 weeks of the test.

Course Learning Outcomes

- CLO1 : Explain the phenomena relating to fluid flows and heat transfer and the underlying mechanisms.
- CLO2 : Apply governing equations to solve fluid flow and heat transfer related questions.
- CLO3 : Analyse fluid flow and heat transfer phenomena in materials engineering in order to generate solutions.

Assessment Length

100 min

Assignment submission Turnitin type

Not Applicable

Hurdle rules

Satisfactory completion of the course includes the requirement to achieve >35% in the mid-term exam and >35% in the final exam, and >45% weighted average over the two exams. Students who fail to achieve this will be awarded an Unsatisfactory Fail (UF) grade for the course regardless if they receive over 50% in total for the course.

Final Exam

Assessment Overview

The final exam will be conducted in formal examination periods to assess your knowledge on the topic of heat transfer.

The two-hour close-book test includes both short-answer and calculation questions.

Feedback is available through inquiry with the course convenor.

Course Learning Outcomes

- CLO1 : Explain the phenomena relating to fluid flows and heat transfer and the underlying mechanisms.
- CLO2 : Apply governing equations to solve fluid flow and heat transfer related questions.
- CLO3 : Analyse fluid flow and heat transfer phenomena in materials engineering in order to generate solutions.

Assessment Length

120 min

Assignment submission Turnitin type

Not Applicable

Hurdle rules

Satisfactory completion of the course includes the requirement to achieve >35% in the mid-term exam and >35% in the final exam, and >45% weighted average over the two exams. Students who fail to achieve this will be awarded an Unsatisfactory Fail (UF) grade for the course regardless if they receive over 50% in total for the course.

General Assessment Information

Please note the times of the in-class quizes may vary depending on the course progress. Check Moodle for latest update.

Grading Basis

Standard

Requirements to pass course

Satisfactory completion of the course includes the requirement to achieve >35% in the mid-term exam and >35% in the final exam, and >45% weighted average over the two exams. Students who fail to achieve this will be awarded an Unsatisfactory Fail (UF) grade for the course regardless if they receive over 50% in total for the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	• Fluid properties and fluid statics • Fundamentals and governing equations of fluid flows
Week 2 : 3 June - 9 June	Blended	• Stress and velocity profiles in laminar flows • Tutorial and in-class quiz • Assignment 1 handed out
Week 3 : 10 June - 16 June	Lecture	• Turbulent flows and friction factor
Week 4 : 17 June - 23 June	Lecture	• Mechanical energy balance • Applications of Bernoulli's equation
Week 5 : 24 June - 30 June	Blended	• Tutorial and in-class quiz • Assignment 1 due • Revision of fluid flows • Mid-term exam
Week 7 : 8 July - 14 July	Lecture	• Introduction of heat transfer • Heat transfer by conduction
Week 8 : 15 July - 21 July	Blended	• Condution with heat source • Tutorial and in-class quiz • Assignment 2 handed out
Week 9 : 22 July - 28 July	Lecture	• Heat transfer by convection • Fundamentals of thermal radiation
Week 10 : 29 July - 4 August	Blended	• Radiation between surfaces • Tutorial and in-class quiz • Revision of heat transfer • Assignment 2 due

Attendance Requirements

Students are strongly encouraged to attend all classes. While the lecture with the slides will be recorded, the writtings on the whiteboard may not be included in the recording. In addition, the tutorial and in-class quiz classes will not be recorded and students need to attend the classes.

Course Resources

Prescribed Resources

- Gaskell, An Introduction to Transport Phenomena in Materials Engineering, Macmillan Company.

Recommended Resources

- Incropera, DeWitt, Bergman and Lavine, Fundamentals of Heat and Mass Transfer (6^{th} ed), John Wiley
- Welty, Wicks, Wilson and Rorrer, Fundamentals of Momentum, Heat, and Mass Transfer (5th ed), Wiley.
- Bird, Stewart and Lightfoot, Transport Phenomena, John Wiley & Sons Inc.
- Additional resource materials including recommended web sites will be provided during class lectures

Course Evaluation and Development

- In-class quiz: solutions will be provided in class. Answer sheets will be uploaded to Moodle.
- Assignments: The assignments will be marked within two weeks after submission.
- Mid-term exam: Students will receive their marks within two weeks of the exam.
- Final exam: Students will receive their final grade when UNSW Sydney realises the marks via MyUNSW.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Runyu Yang		Room 349 Hilmer Building E10		By appointment	Yes	Yes
Lecturer	Rumana Hossain					No	No

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW

community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines