UNSW Course Outline

ZEIT4707 Mechanical Design 2 - 2024

Published on the 11 Feb 2024

General Course Information

Course Code : ZEIT4707
Year : 2024
Term : Semester 1
Teaching Period : Z1
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : School of Engineering and Technology
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course fits in the design stream for mechanical engineering program. It follows on from ZEIT1501 Engineering Practice and Design, ZEIT2501 Mechanical and Electronic Design and ZEIT4706 Mechanical Design 1.

It is assumed that you have successfully completed all core courses to the end of Third Year in the program 4474 Mechanical Engineering: if you have not done so, you should consult with the lecturer before commencing this course.

Mechanical design uses appropriate techniques to apply knowledge so that machines and systems can be constructed to satisfy requirements. Although the requirements are the yardstick for successful design, the design engineer is often presented with ones which are inadequate to specify the design completely and must negotiate expanded requirements to do so. It is the objective of this course to engage the participants in all aspects of the design process on a well-defined “machine”. The course also introduces principles of design optimization that is increasingly becoming an integral part of the design process.

This 6-unit course is divided into two parts: Design Optimization (50%) and Mechanical Design Project (50%). Lectures and Studio sessions will be used throughout the session to cover the above two aspects.

Course Aims

This course aims to introduce students to designing real life systems using multidisciplinary analysis in the face of uncertainty and methods to model and solve such classes of problems.

Relationship to Other Courses

ZEIT4706 Mechanial Design 1 (previously ZEIT 3700) is the pre-requisite for ZEIT4707; which implicitly assumes knowledge of the preceding design-related courses listed above. If you have not completed ZEIT4706/ZEIT3700, you should consult with the course instructors before commencing this course.

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Find the available information relevant to a design question posed to you. Negotiate to produce consistent requirements and break the design into system specifications.	• PEE1.6 : Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline • PEE2.4 : Application of systematic approaches to the conduct and management of projects within the technology domain • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE3.6 : Effective team membership and team leadership
CLO2 : Assess the quality of the potential solutions, negotiate conflicts between systems solutions and adapt to changes to the design and associated planning during the process. Integrate them into a detailed design package and verify design performance through prototyping and testing.	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE3.4 : Professional use and management of information • PEE3.5 : Orderly management of self, and professional conduct • PEE3.6 : Effective team membership and team leadership
CLO3 : Produce and/or supervise the integration of CAD models for the design.	• PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering techniques, tools and resources • PEE3.5 : Orderly management of self, and professional conduct
CLO4 : Understand the fundamental principles behind formulation of optimization problems and optimization techniques	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering

	discipline • PEE2.3 : Application of systematic engineering synthesis and design processes
CLO5 : Show a deep understanding of the concepts and computational methods and tools for optimization, demonstrated through their choice and usage. Provide substantial analysis and insights into the results obtained through optimization exercises.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering techniques, tools and resources • PEE3.2 : Effective oral and written communication in professional and lay domains

Course Learning Outcomes	Assessment Item
CLO1 : Find the available information relevant to a design question posed to you. Negotiate to produce consistent requirements and break the design into system specifications.	• Interim Design Report • Product testing, final report and presentation • Individual reflection and viva
CLO2 : Assess the quality of the potential solutions, negotiate conflicts between systems solutions and adapt to changes to the design and associated planning during the process. Integrate them into a detailed design package and verify design performance through prototyping and testing.	• Interim Design Report • Product testing, final report and presentation • Individual reflection and viva
CLO3 : Produce and/or supervise the integration of CAD models for the design.	• Interim Design Report • Product testing, final report and presentation • Individual reflection and viva
CLO4 : Understand the fundamental principles behind formulation of optimization problems and optimization techniques	• Optimization Test x 2 • Optimization Assignment • Interim Design Report • Product testing, final report and presentation
CLO5 : Show a deep understanding of the concepts and computational methods and tools for optimization, demonstrated through their choice and usage. Provide substantial analysis and insights into the results obtained through optimization exercises.	• Optimization Test x 2 • Optimization Assignment • Interim Design Report • Product testing, final report and presentation

Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate | Echo 360

Learning and Teaching in this course

The course is expected to run fully in-person mode. Moodle Collaborate or other online tools (e.g. Microsoft teams/Zoom) will be used in case of any unforeseen disruptions.

The Learning Management System

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester. Please find all help and documentation (including Blackboard Collaborate) at the Moodle Support page.

UNSW Moodle supports the following web browsers:

» Google Chrome 50+
» Safari 10+
** Internet Explorer is not recommended

** Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:

Windows 7, 10, Mac OSX Sierra, iPad IOS10

For further details about system requirements click here.

Log in to Moodle here.

If you need further assistance with Moodle:

For enrolment and login issues please contact:
IT Service Centre
Email: itservicecentre@unsw.edu.au
Phone: (02) 9385-1333
International: +61 2 9385 1333

For all other Moodle issues please contact:

External TELT Support
Email: externalteltsupport@unsw.edu.au
Phone: (02) 9385-3331
International: +61 2 938 53331

Opening hours:
Monday – Friday 7:30am – 9:30 pm
Saturday & Sunday 8:30 am – 4:30pm

Additional Course Information

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct https://www.unsw.edu.au/content/dam/pdfs/governance/policy/accessible/studentcode.pdf

Plagiarism undermines academic integrity and is not tolerated at UNSW. *It is defined as using the words or ideas of others and passing them off as your own, and* can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement. For more information, please refer to the following: https://student.unsw.edu.au/plagiarism

Use of AI

The permitted use of AI in the assessments will vary for each inviditual assessment item. For example, no AI (or other resources) may be used for the in-class closed-book tests. For the take-home assessments (assignment, design report, etc.), the extent of AI permitted and appropriate referencing requirements will be indicated on the assignment descriptions.

Referencing

In this course, students are required to reference following the APA 7 / Chicago NB referencing style. Information about referencing styles is available at: https://guides.lib.unsw.adfa.edu.au/c.php?g=472948&p=3246720

Study at UNSW Canberra

https://www.unsw.adfa.edu.au/study

Study at UNSW Canberra has lots of useful information regarding:

- Where to get help
- Administrative matters
- Getting your passwords set up
- How to log on to Moodle
- Accessing the Library and other areas.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Engineers Australia - Professional Engineer (Stage 1)
Optimization Test x 2 Assessment Format: Individual	25%	Start Date: Not Applicable Due Date: First test: week 4; Second test: week 9	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.3 : Application of systematic engineering synthesis and design processes
Interim Design Report Assessment Format: Group	10%	Due Date: Week 6: 01 April - 05 April	• PEE1.6 : Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline • PEE2.4 : Application of systematic approaches to the conduct and management of projects within the technology domain • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE3.6 : Effective team membership and team leadership
Optimization Assignment Assessment Format: Individual	25%	Due Date: Week 13: 03 June - 07 June	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline

			• PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering techniques, tools and resources • PEE3.2 : Effective oral and written communication in professional and lay domains
Product testing, final report and presentation Assessment Format: Group	20%	Due Date: Week 13: 03 June - 07 June	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE3.4 : Professional use and management of information • PEE3.5 : Orderly management of self, and professional conduct • PEE3.6 : Effective team membership and team leadership • PEE2.2 : Fluent application of engineering techniques, tools and resources

Individual reflection and viva Assessment Format: Individual	20%	Due Date: During exam period	• PEE3.2 : Effective oral and written communication in professional and lay domains • PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.4 : Professional use and management of information • PEE3.5 : Orderly management of self, and professional conduct • PEE3.6 : Effective team membership and team leadership

Assessment Details

Optimization Test x 2

Assessment Overview

The class tests will assess the understanding of optimization concepts. Quiz 1 worth 10%, Quiz 2 worth 15%

Course Learning Outcomes

- CLO4 : Understand the fundamental principles behind formulation of optimization problems and optimization techniques
- CLO5 : Show a deep understanding of the concepts and computational methods and tools for optimization, demonstrated through their choice and usage. Provide substantial analysis and insights into the results obtained through optimization exercises.

Detailed Assessment Description

Individual topics covered under each quiz will be notified a week in advance.

Assessment Length

The tests will typically closed book and run for 60-90 minutes.

Assessment information

The first test will be in Week 4 (March 22). The second quiz will be in Week 9 (8 May)

Assignment submission Turnitin type

Not Applicable

Interim Design Report

Assessment Overview

Interim report for the design project.

Course Learning Outcomes

- CLO1 : Find the available information relevant to a design question posed to you. Negotiate to produce consistent requirements and break the design into system specifications.
- CLO2 : Assess the quality of the potential solutions, negotiate conflicts between systems solutions and adapt to changes to the design and associated planning during the process. Integrate them into a detailed design package and verify design performance through prototyping and testing.
- CLO3 : Produce and/or supervise the integration of CAD models for the design.
- CLO4 : Understand the fundamental principles behind formulation of optimization problems and optimization techniques
- CLO5 : Show a deep understanding of the concepts and computational methods and tools for optimization, demonstrated through their choice and usage. Provide substantial analysis and insights into the results obtained through optimization exercises.

Detailed Assessment Description

More details will be provided via class discussions and Moodle.

Assignment submission Turnitin type

Not Applicable

Optimization Assignment

Assessment Overview

Take home assignment on optimization.

Course Learning Outcomes

- CLO4 : Understand the fundamental principles behind formulation of optimization problems and optimization techniques
- CLO5 : Show a deep understanding of the concepts and computational methods and tools for

optimization, demonstrated through their choice and usage. Provide substantial analysis and insights into the results obtained through optimization exercises.

Detailed Assessment Description

More details will be provided via class discussions and Moodle.

Assignment submission Turnitin type

Not Applicable

Product testing, final report and presentation

Assessment Overview

Group performance for design project, evaluated through final report, presentation and product testing.

Course Learning Outcomes

- CLO1 : Find the available information relevant to a design question posed to you. Negotiate to produce consistent requirements and break the design into system specifications.
- CLO2 : Assess the quality of the potential solutions, negotiate conflicts between systems solutions and adapt to changes to the design and associated planning during the process. Integrate them into a detailed design package and verify design performance through prototyping and testing.
- CLO3 : Produce and/or supervise the integration of CAD models for the design.
- CLO4 : Understand the fundamental principles behind formulation of optimization problems and optimization techniques
- CLO5 : Show a deep understanding of the concepts and computational methods and tools for optimization, demonstrated through their choice and usage. Provide substantial analysis and insights into the results obtained through optimization exercises.

Detailed Assessment Description

More details will be provided via class discussions and Moodle.

Individual reflection and viva

Assessment Overview

Individual performance assessment for project through a reflective report and viva.

Course Learning Outcomes

- CLO1 : Find the available information relevant to a design question posed to you. Negotiate to produce consistent requirements and break the design into system specifications.
- CLO2 : Assess the quality of the potential solutions, negotiate conflicts between systems solutions and adapt to changes to the design and associated planning during the process. Integrate them into a detailed design package and verify design performance through

prototyping and testing.
- CLO3 : Produce and/or supervise the integration of CAD models for the design.

Detailed Assessment Description

More details will be provided via class discussions and Moodle.

General Assessment Information

Students will get the written feedback of optimization test 1 by the census date (24 March).

The students would note that the course assessments are often open ended, which is intentional and in-line with preparing the senior undergraduate students to embark on their professional career. Accordingly, they need to take lead of their own projects and manage their time efficiently. The outcomes that they achieve in the course will depend on how well they engage in undertakings of the course.

Late submissions (applicable to take home assignments): Unless prior arrangement is made with the lecturer or a formal application for special consideration is submitted, a penalty of 5% of the total available mark for the assessment will apply for each day that an assessment item is late up to a maximum of 5 days (120 hours) after which an assessment can no longer be submitted and a grade of 0 will be applied.

Use of AI

The permitted use of AI in the assessments will vary for each inviditual assessment item. For example, no AI (or other resources) may be used for the in-class closed-book tests. For the take-home assessments (assignment, design report, etc.), the extent of AI permitted and appropriate referencing requirements will be indicated on the assignment descriptions.

Grading Basis

Standard

Requirements to pass course

A minimum of 50% marks are required in each component (optimization and design project) for passing the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	• Wed: Intro to the course (HS/TR) • Thur: Design (TR) • Fri: Optimization (HS)
Week 2 : 4 March - 8 March	Lecture	• Wed: Optimization (HS) • Thur: Design Project / Self-study • Fri: Optimization (HS)
Week 3 : 11 March - 15 March	Lecture	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Optimization (HS)
Week 4 : 18 March - 22 March	Blended	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Optimization Test 1
	Assessment	Optimization Test 1
Week 5 : 25 March - 29 March	Lecture	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Good Friday
Week 6 : 1 April - 5 April	Blended	• Wed: Design (TR) • Thur: Interim design report • Fri: Optimization (HS)
	Assessment	Interim design report
Week 7 : 22 April - 26 April	Lecture	• Wed: Militray Training Day • Thur: Anzac Day • Fri: Optimization (HS)
Week 8 : 29 April - 3 May	Lecture	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Optimization (HS)
Week 9 : 6 May - 10 May	Blended	• Wed: Optimization Test 2 • Thur: Design Project / Self-study • Fri: Optimization (HS)
	Assessment	Optimization Test 2
Week 10 : 13 May - 17 May	Lecture	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Optimization (HS)
Week 11 : 20 May - 24 May	Lecture	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Optimization (HS)
Week 12 : 27 May - 31 May	Lecture	• Wed: Design (TR) • Thur: Design Project / Self-study • Fri: Optimization (HS)
Week 13 : 3 June - 7 June	Blended	• Wed: Product Testing, Final Report and Presentation • Thur: Design Project / Self-study • Fri: Optimization assignment due
	Assessment	Product Testing, Final Report and Presentation Optimization assignment Individual reflection and viva (17th of June)

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

In each week, there will be:

- One session (max 2hrs) on Optimization

- One session (max 2 hrs) on Design project
- One session that will be mostly unsupervised, where students are expected to get together and work on their projects. Occasionally the session may also be used for covering off supplementary content.

A more detailed schedule in a Table format will be available on Moodle with sessions, instructors, assignment submission dates, etc.

Course Resources

Prescribed Resources

For optimization component of the course, the following two books will be heavily referenced:

"Engineering Design Optimization" by Joaquim R. R. A Martins and Andrew Ning. This book is freely available to download from https://mdobook.github.io/

"Essentials of Metaheuristics" by Sean Luke. This book is freely available to download from https://cs.gmu.edu/~sean/book/metaheuristics/

However, it is important to note that given the nature of the course, the textbooks will not be strictly followed as optimization involves a range of tools and techniques, including some that maybe out of scope of these books.

Recommended Resources

The above books as well as some other relevant resources including key research papers, lecture notes, slides, etc. will be provided through Moodle. Depending on their projects and assignments, the students may need to gather information from several different sources (e.g. books, websites, videos, etc.) for their projects. We would like to stress that learning how to access relevant design information is an essential part of the course.

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course. Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to

see how the feedback from previous students has contributed to the course development. Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf.

A number of enhancements have been incorporated in the course over the years based on student and peer-reviews, including (but not limited to): advising the students regarding open-ended nature of the course and expectations, inclusion of design projects that are of more current relevance in terms of up-and-coming technologies, inclusion of physical prototyping of the designs, updates in the books used for the course, and the notes/slides. More recently, the group sizes for design project have also been reduced (to max 6) based on previous feedback.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Hemant Singh		Room 103, B20, UNSW Canberra	+61 2 5114 5206	Available for individual consultations through appointments during the weekdays working hours 9am-5pm. Based on mutual availability and campus access, the consultations could be face-to-face, virtual/online via Teams or Collaborate Ultra.	Yes	Yes
Lecturer	Tapabrata Ray		Room 202, B17, UNSW Canberra	+61 2 5114 5201	Available for individual consultations through appointments during the weekdays working hours 9am-5pm. Based on mutual availability and campus access, the consultations could be face-to-face, virtual/online via Teams or Collaborate Ultra.	No	No

Other Useful Information

Academic Information

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in

schools, informal feedback conducted by staff, and focus groups (where applicable). Student opinions really do make a difference. Refer to the Moodle site for your course to see how the feedback from previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct.

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitible Learning Services team. Equitable Learning Services is a free and confidential service that provides practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: https://www.student.unsw.edu.au/equitable-learning

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct. Find relevant information at: Student Code of Conduct (unsw.edu.au)

Plagiarism undermines academic integrity and is not tolerated at UNSW. It is defined as using the words or ideas of others and passing them off as your own, and can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

Submission of Assessment Tasks

Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: https://www.student.unsw.edu.au/special/consideration/guide

Or apply for special consideration through your MyUNSW portal.

Late Submission of assessment tasks (other than examinations)

UNSW has a standard late submission penalty of:

- 5% per day,

- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

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

Electronic submission of assessment

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

Release of final mark

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.