UNSW Course Outline

ZEIT4504 Electrical and Mechanical Plant - 2024

Published on the 13 Jul 2024

General Course Information

Course Code : ZEIT4504
Year : 2024
Term : Semester 2
Teaching Period : Z2
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

Electrical and Mechanical Plant (ZEIT 4504) provides final year students with knowledge and skills required to analyse and design mechanical equipment and systems. This is a six unit of credit course with four contact hours per week – generally lectures, with occasional laboratory

sessions. This is a course aimed at mechanical engineers and therefore the types of plant covered are those for which a mechanical engineer may be responsible, whether for design, operation or maintenance.

Course Aims

Successful completion of this course contributes to the acquisition of UNSW graduate capabilities. UNSW aspires to develop globally focused graduates who are rigorous scholars, capable ofleadership and professional practice in an international community.

At the successful conclusion of this course students will be able to:

LO1: explain the design features and practical constraints of plant machines.

LO2: describe the essential features of electrical and mechanical machines.

LO3: Undertake a concept design brief for a range of mechanical systems.

LO4: calculate, analyse and evaluate the performance and technical specifications of plant machineries.

LO5: describe the operating principals of electrical generation and electronic and electrical power conversion equipment.

Relationship to Other Courses

Assumed knowledge is found in foundational engineering courses. The prerequisite for this course is ZEIT 2501 Mechanical and Electronic Design.

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Engineering Technologist (Stage 1)
CLO1 : Explain the design features and practical constraints of plant machines.	• ET1.1 : Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain • ET1.3 : In-depth understanding of specialist bodies of knowledge within the technology domain • ET1.5 : Knowledge of engineering design practice and contextual factors impacting the technology domain • ET1.6 : Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the technology domain
CLO2 : Describe the essential features of electrical and mechanical machines.	• ET1.6 : Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the technology domain • ET2.2 : Application of engineering techniques, tools and resources within the technology domain
CLO3 : Undertake a concept design brief for a range of mechanical systems.	• ET1.5 : Knowledge of engineering design practice and contextual factors impacting the technology domain • ET2.1 : Application of established engineering methods to broadly-defined problem solving within the technology domain • ET3.5 : Orderly management of self, and professional conduct
CLO4 : Calculate, analyse and evaluate the performance and technical specifications of plant machineries.	• ET2.1 : Application of established engineering methods to broadly-defined problem solving within the technology domain • ET2.2 : Application of engineering techniques, tools and resources within the technology domain
CLO5 : Describe the operating principals of electrical generation and electronic and electrical power conversion equipment.	• ET1.1 : Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain • ET1.5 : Knowledge of engineering design practice and contextual factors impacting the technology domain • ET1.6 : Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the

	technology domain • ET2.1 : Application of established engineering methods to broadly-defined problem solving within the technology domain • ET2.2 : Application of engineering techniques, tools and resources within the technology domain • ET3.5 : Orderly management of self, and professional conduct

Course Learning Outcomes	Assessment Item
CLO1 : Explain the design features and practical constraints of plant machines.	• In-Class Assessment • Electric Lab Report • HVAC System Sizing Report
CLO2 : Describe the essential features of electrical and mechanical machines.	• Mechanical Lab Report • Electrical Systems Sizing Report • Electric Lab Report • HVAC System Sizing Report
CLO3 : Undertake a concept design brief for a range of mechanical systems.	• Mechanical Lab Report • HVAC System Sizing Report
CLO4 : Calculate, analyse and evaluate the performance and technical specifications of plant machineries.	• In-Class Assessment • Electrical Systems Sizing Report • Electric Lab Report • HVAC System Sizing Report
CLO5 : Describe the operating principals of electrical generation and electronic and electrical power conversion equipment.	• Electrical Systems Sizing Report • Electric Lab Report

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

This course contributes to all the Engineers Australia Stage 1 Competencies 1.1-1.6, 2.1-2.4, 3.1-3.6

1.1. Comprehensive, theory-based understanding of the underpinning natural and physical

sciences and the engineering fundamentals applicable to the engineering discipline.

1.2. Conceptual understanding of the mathematics, numerical analysis, statistics,

and computer and information sciences which underpin the engineering discipline.

1.3. In-depth understanding of specialist bodies of knowledge within the

engineering discipline.

1.4. Discernment of knowledge development and research directions within the

engineering discipline.

1.5. Knowledge of contextual factors impacting the engineering discipline.

1.6. Understanding of the scope, principles, norms, accountabilities and bounds

of contemporary engineering practice in the specific discipline.

2.1. Application of established engineering methods to complex engineering problem solving.

2.2. Fluent application of engineering techniques, tools and resources.

2.3. Application of systematic engineering synthesis and design processes.

2.4. Application of systematic approaches to the conduct and management of engineering

projects.

3.1. Ethical conduct and professional accountability

3.2. Effective oral and written communication in professional and lay domains.

3.3. Creative, innovative and pro-active demeanour.

3.4. Professional use and management of information.

3.5. Orderly management of self, and professional conduct.

3.6. Effective team membership and team leadership.

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

Other Professional Outcomes

At the successful conclusion of this course students will be able to:

LO1: explain the design features and practical constraints of plant machines.

LO2: describe the essential features of electrical and mechanical machines.

LO3: Undertake a concept design brief for a range of mechanical systems.

LO4: calculate, analyse and evaluate the performance and technical specifications of plant machineries.

LO5: describe the operating principals of electrical generation and electronic and electrical power conversion equipment.

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

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.*

Additional Information as required

CRICOS Provider no. 00098G

The University of New South Wales Canberra.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Engineers Australia - Engineering Technologist (Stage 1)
In-Class Assessment Assessment Format: Individual	40%	Start Date: There are 4 quizzes set as Assessment No 1- These 4 quizzes will be run in W3-W6 during tutorial.. Due Date: There are 4 quizzes set as Assessment No 1- These 4 quizzes will be run in W3-W6 during tutorial.	• ET1.1 : Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain • ET1.3 : In-depth understanding of specialist bodies of knowledge within the technology domain
Mechanical Lab Report Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Week 7: 09 September - 13 September	• ET2.1 : Application of established engineering methods to broadly-defined problem solving within the technology domain • ET2.2 : Application of engineering techniques, tools and resources within the technology domain • ET3.5 : Orderly management of self, and professional conduct
Electric Lab Report Assessment Format: Individual	15%	Start Date: Not Applicable Due Date: Week 7: 09 September - 13 September, Week 8: 16 September - 20 September, Week 9: 23 September - 27 September	
Electrical Systems Sizing Report Assessment Format: Individual	15%	Start Date: Not Applicable Due Date: Week 10: 30 September - 04 October	
HVAC System Sizing Report Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: 04/11/2024 11:55 PM	

Assessment Details

In-Class Assessment

Assessment Overview

4x10%

Course Learning Outcomes

- CLO1 : Explain the design features and practical constraints of plant machines.
- CLO4 : Calculate, analyse and evaluate the performance and technical specifications of plant machineries.

Detailed Assessment Description

There would be 4 quizzes on different topics as below :

Quiz 1

On heat exchangers

31 JUL Wednesday Week 3 (17:00-18:00)

Quiz 2

On Piping

07 AUG Wednesday Week 4 (17:00-18:00)

Quiz 3

On Pumps

14 AUG Wednesday Week 5 (17:00-18:00)

Quiz 4

On Fire safety and sprinkler system design

21 AUG Wednesday Week 6 (17:00-18:00)

Assessment Length

In Class -Quiz

Submission notes

In- class paper quizzes - Please refer to "Additional Information" Section

Assessment information

Assessment 1 consists of 4 in-class quizzes starting from W3 and ending in W6

Quizzes will be run on Wednesdays of W3, W4, W5 and W6 (17:00-18:00)

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Mechanical Lab Report

Assessment Overview

n/a

Course Learning Outcomes

- CLO2 : Describe the essential features of electrical and mechanical machines.
- CLO3 : Undertake a concept design brief for a range of mechanical systems.

Detailed Assessment Description

Lab report (10%): instruction
•A 5 pages lab report needed as part of this assessment (excluding cover and title page and references)
•Font size 11 , Arial
•Reference style (Harvard)
•Appendices are allowed [up to 4 pages (excluding the 5 pages body of the report)]
•The report is to be on selected topic focused on the application of one of the three instrumentations presented during the lab time, namely :

1- Burner Box OR

2-Smouldering test device OR

3-Oxygen index analyzer

4- Structural Cohesion Tester

More details

Due date : 10/09/2024

•Pick one of the topics listed in Moodle undet "Mechanical Lab report Topics"
•Write a mini research article on the application of the lab facility in tackling a specific problem

•The report shall have the following sections
1.An abstract (gist of the project): one or two paragraphs
2.A literature survey (introduction): up to one page
3.Research gap/ research question(1 paragraph)
4. Methodology : any existing methodology either experimental of numerical with any figure or table (do not forget to reference any figure or table you have borrowed from any papers)
5.Your proposed methodology to compliment existing ones
6.Conclusion

This 6 section (body of the report) should not be more than 5 pages

Reference and appendices can be added on top of 5 pages

Assessment Length

5 Page

Submission notes

To be instructed in the tutorial session

Assessment information

•Sample research papers on the 4 instrumentations will be shared with via Moodle in 4 distinct folders under (Mechanical Lab section)
•Please use these papers as sample and do your own research by exploring the literature and finding more papers in the field to be used in writing your report

Deadline of submission via Moodle is 11:59 pm 10 September
Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Electric Lab Report

Assessment Overview

3x5%

Course Learning Outcomes

- CLO1 : Explain the design features and practical constraints of plant machines.
- CLO2 : Describe the essential features of electrical and mechanical machines.
- CLO4 : Calculate, analyse and evaluate the performance and technical specifications of plant machineries.
- CLO5 : Describe the operating principals of electrical generation and electronic and electrical power conversion equipment.

Detailed Assessment Description

Lab reports submitted following electrical labs sessions on motors and control. Students submit the lab report at the conclusion of the lab.

Assessment Length

1- 2 page reports for each lab

Assignment submission Turnitin type

Not Applicable

Electrical Systems Sizing Report

Assessment Overview

n/a

Course Learning Outcomes

- CLO2 : Describe the essential features of electrical and mechanical machines.
- CLO4 : Calculate, analyse and evaluate the performance and technical specifications of plant machineries.
- CLO5 : Describe the operating principals of electrical generation and electronic and electrical power conversion equipment.

Detailed Assessment Description

Chose and size appropriate systems for electrical generation, distribution and drives.

Assessment Length

4-10 page report

Assignment submission Turnitin type

Not Applicable

HVAC System Sizing Report

Assessment Overview

n/a

Course Learning Outcomes

- CLO1 : Explain the design features and practical constraints of plant machines.
- CLO2 : Describe the essential features of electrical and mechanical machines.
- CLO3 : Undertake a concept design brief for a range of mechanical systems.
- CLO4 : Calculate, analyse and evaluate the performance and technical specifications of plant machineries.

Detailed Assessment Description

Chose and size the equipment and arrangement for a heating, ventilation and air-conditioning requirement.

Assessment Length

4-10 page report

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Assessment Requirements

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.**

Assessment

1) In-class assessment (during tutorials) = 4 x 10% Each session of tutorials

There are 4 quizzes set as Assessment No 1- These 4 quizzes will be run in W3-W6.

Quiz 1: 31 JUL Wednesday Week 3 (17:00-18:00)

Quiz 2: 07 AUG Wednesday Week 4 (17:00-18:00)

Quiz 3: 14 AUG Wednesday Week 5 (17:00-18:00)

Quiz 4: 21 AUG Wednesday Week 6 (17:00-18:00)

2) Mechanical Lab report (1 x 10%)

Due date : 10/09/2024

3) Electrical Lab Report = 3 x 5% (Each Electrical Lab Session)

5) Electrical system sizing report 15%

6) HVAC system sizing report 20%

Note: All assessments are individual. This course does not have group assessment.

Assessed documents are to be handed to the course staff as directed.

Submitted work is due by on the dates identified in the schedule / handout.

Individual assignments are to be an individual's own independent work. Students MUST declare originality (eg by signing a coversheet for paper-based submission or including an attesting statement in electronic submissions). All materials submitted must be legible and logical in presentation. Marks will reflect an assessment of these characteristics.

Students will get the feedback of the first in-class assessment by the census date.

Late Submission of Assessment

- 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 Generative AI in Assessments

-SIMPLE EDITING ASSISTANCE

For assessment tasks of this course , you may use standard editing and referencing software, but not Generative AI. You are permitted to use the full capabilities of the standard software to answer the question (e.g. you may wish to specify particular software such as Microsoft Office suite, Grammarly, etc.).

If the use of generative AI such as ChatGPT is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

Grading Basis

Standard

Requirements to pass course

The overall passing mark is set at 50% by the university. The minimum 50% mark must be obtained in both mechanical and electrical parts of the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 15 July - 19 July	Lecture	Lecture 1: Course Overview and Introduction to Mechanical Plant (Tuesday) • Tuesday : 14:00-16:00 Lecture 2: Heat Exchanger Design (Wednesday) • Wednesday : 13:00-15:00
	Tutorial	Tutorial No 1 : Wednesday 17:00- 18:00
Week 2 : 22 July - 26 July	Tutorial	Tutorial No 2 : Wednesday 17:00- 18:00
	Lecture	Lecture 3 : Heat Exchanger sizing • Tuesday : 14:00-16:00 Lecture 4: Piping vs Pipeline Engineering • Wednesday : 13:00-15:00
Week 3 : 29 July - 2 August	Lecture	Lecture 5: Mechanical pumps and pipework systems • Tuesday : 14:00-16:00 Lecture 6: Gas Turbine • Wednesday : 13:00-15:00
	Tutorial	Tutorial No 3 : Wednesday 17:00- 18:00
	Laboratory	• Mechanical lab: Thursday 14:00-16:00, Friday 14:00- 16:00
Week 4 : 5 August - 9 August	Lecture	Lecture 7: Introduction to Fire Safety (Fire Safety for Manufacturing Plants) • Tuesday : 14:00-16:00 Lecture 8: Compartment Fire Growth • Wednesday : 13:00-15:00
	Tutorial	Tutorial No 4 : Wednesday 17:00- 18:00
Week 5 : 12 August - 16 August	Lecture	Lecture 9 & 10: Fire Extinguisher Maintenance and Inspections, Design of Sprinkler Systems • Wednesday : 13:00-15:00
	Tutorial	Tutorial No 5: Wednesday 17:00- 18:00
Week 6 : 19 August - 23 August	Lecture	Lecture 11: Fire Protection Solutions in the Military • Tuesday : 14:00-16:00 Lecture 12: Lecture 1-11 Review • Wednesday : 13:00-15:00
	Tutorial	Tutorial No 6: Wednesday 17:00- 18:00
Week 7 : 9 September - 13 September	Lecture	Lecture 12: Spare • Tuesday : 14:00-16:00 Lecture 13: Electrical Theory & Safety • Wednesday : 13:00-15:00
	Laboratory	Power Lab: Thursday 14:00-16:00, Friday 14:00- 16:00
Week 8 : 16 September - 20 September	Lecture	Lecture 14: Electrical Power Generation • Tuesday : 14:00-16:00 No Wednesday Lecture - MTD
	Laboratory	Power Lab: Thursday 14:00-16:00, Friday 14:00- 16:00
Week 9 : 23 September - 27 September	Lecture	Lecture 15: Electrical Motors • Tuesday : 14:00-16:00 Lecture 16: Electrical Power conversion • Wednesday : 13:00-15:00
	Laboratory	Power Lab: Thursday 14:00-16:00, Friday 14:00- 16:00
Week 10 : 30 September - 4 October	Lecture	Lecture 17: Electrical Distribution • Tuesday : 14:00-16:00 Lecture 18: HVAC – Heating and Cooling Machinery • Wednesday : 13:00-15:00
	Activity	Plant room visit: Thursday 14:00-16:00, Friday 14:00- 16:00
Week 11 : 7 October - 11 October	Lecture	Lecture 19: HVAC – Ventilation • Tuesday : 14:00-16:00 Lecture 20: Fresh Water Generation and Distribution & Sewerage • Wednesday : 13:00-15:00
Week 12 : 14 October - 18 October	Lecture	Lecture 21: HVAC – Ventilation • Tuesday : 14:00-16:00 Lecture 22: Control & Monitoring • Wednesday : 13:00-15:00
	Laboratory	Power Lab: Thursday 14:00-16:00, Friday 14:00- 16:00
Week 13 : 21 October - 25 October	Lecture	Lecture 23: Maintenance Management

		• Tuesday : 14:00-16:00 Lecture 24: Review L13-23 • Wednesday : 13:00-15:00

Attendance Requirements

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

General Schedule Information

Lectures : Tuesdays 14:00-16:00

Wednesdays 13:00-15:00

Tutorials : *Wednesdays 17:00- 18:00*

Labs: *Thursdays 14:00-16:00*

Fridays 14:00 -16:00

Course Resources

Prescribed Resources

Range of articles shared in Moodle

Recommended Resources

Recommended Readings:

· Reading First read through chapter 1, section 2.2, 11.1 and 12.13 in the “Pump Handbook”, Fourth Edition by Igor J. KarassikJoseph P. MessinaPaul CooperCharles C. Heald. Available at UNSW Library – online resource.

· Piping calculations manual, by Shashi Menon, section 1.6: UNSW Library - online: https:// www.accessengineeringlibrary.com/co ntent/book/9780071440905/chapter/chap ter1#/ c9780071440905ch01lev1sec07

· chapter 1, section 2.3 and chapter 3 “Heat Transfer Textbook”, Fourth Edition by Lienhard, J. H. Available at UNSW Library – online resource. Note particularly the information on shell and tube, and the plate type heat exchangers as these are the most commonly used type of heat exchangers in mechanical applications.

· The Australian Institute of Refrigeration, Airconditioning and heating have much interesting material relating to land-based air conditioning practice on their website AIRAH website (https://www.airah.org.au/). If you look through the Resources menu, they have many technical presentations from past forums and from the divisions in the various states.

Additional Costs

N/A

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

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Maryam Ghodrat		B17, Room 130	0251145153	By appointment	No	Yes
Lecturer	Sean McCracken		Building 20 Room 105	0420935285	Meetings can be arranged after class or by email	No	No