



UNSW Course Outline

PTRL5022 Drilling Systems Design and Optimisation - 2024

Published on the 17 May 2024

General Course Information

Course Code : PTRL5022

Year : 2024

Term : Term 2

Teaching Period : T2

Is a multi-term course? : No

Faculty : Faculty of Engineering

Academic Unit : School of Minerals & Energy Resources Engineering

Delivery Mode : In Person

Delivery Format : Standard

Delivery Location : Kensington

Campus : Sydney

Study Level : Postgraduate

Units of Credit : 6

Useful Links

[Handbook Class Timetable](#)

Course Details & Outcomes

Course Description

The course covers both the theory and practical applications of casing design and directional drilling technology. The combined lectures, workshops and design projects will provide students with a comprehensive understanding of the following aspects: prediction of formation pore

pressure and stress gradients; determination of safe mud weight bounds for different in-situ stress conditions; casing types and functions; API casing manufacturing, dimensions, weights, grades, casing couplings and threads; performance properties of the casing under load conditions (tension, burst and collapse); casing design principals and procedures; casing design in deviated and horizontal wells; design and planning well trajectory; surveying tools, procedures and calculation methods; deflecting tools and directional control; drill string and bottom hole assembly; downhole mud motors; drilling methods and equipment for directional, horizontal and multilateral wells.

Course Aims

The course aims to enable students to acquire fundamental knowledge of well systems design and optimization and to apply the theory to the design, evaluation and optimization of casing program, well trajectory and drilling program. The course will reinforce students' understanding of the core aspects of well construction and the inter relationship between wellbore and reservoirs.

Relationship to Other Courses

This is a core course of the program with a prerequisite of PTRL5009.

Course Learning Outcomes

Course Learning Outcomes
CL01 : Design and evaluate casing programs and casing strings;
CL02 : Plan well trajectory;
CL03 : Evaluate survey calculation methods;
CL04 : Select proper wellbore direction and deviation control methods and tools.

Course Learning Outcomes	Assessment Item
CL01 : Design and evaluate casing programs and casing strings;	<ul style="list-style-type: none">• Assignments• Midterm Exam• Project• Final Exam
CL02 : Plan well trajectory;	<ul style="list-style-type: none">• Assignments• Midterm Exam• Project• Final Exam
CL03 : Evaluate survey calculation methods;	<ul style="list-style-type: none">• Assignments• Midterm Exam• Project• Final Exam
CL04 : Select proper wellbore direction and deviation control methods and tools.	<ul style="list-style-type: none">• Assignments• Midterm Exam• Project• Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate | Echo 360

Learning and Teaching in this course

The course contains weekly lectures, in-class exercises and home works. The assessment includes assignments, project, midterm quiz and final exam.

Other Professional Outcomes

N/A

Additional Course Information

N/A

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignments Assessment Format: Individual Short Extension: Yes (7 days)	20%	Due Date: Assignments due at the end of Weeks 3, 5, 7, 9 respectively, practical exercises due weekly.
Midterm Exam Assessment Format: Individual	20%	Due Date: Midterm quiz due in Week 7
Project Assessment Format: Individual Short Extension: Yes (7 days)	10%	Due Date: Week 10
Final Exam Assessment Format: Individual	50%	Due Date: During the Exam Period

Assessment Details

Assignments

Assessment Overview

There are 4 parts to the assignment which cover lecture topics of previous weeks. Marking will be against specific criteria in a marking guide and Individual written feedback will be provided within ten days of the relevant submission date through the Learning Management System. Verbal class-wide feedback will be provided in class during assignment reviews.

Course Learning Outcomes

- CL01 : Design and evaluate casing programs and casing strings;
- CL02 : Plan well trajectory;
- CL03 : Evaluate survey calculation methods;
- CL04 : Select proper wellbore direction and deviation control methods and tools.

Detailed Assessment Description

The first assignment is due on week 3 and the feedback will be provided before 22 June 2024.

Assessment Length

No more than 10 pages

Submission notes

Online submission

Assessment information

The specifications and marking rubrics will be provided at the time of the assignment release.

Assignment submission Turnitin type

This is not a Turnitin assignment

Midterm Exam

Assessment Overview

The midterm quiz covers lecture topics from W1 to W5. Marking will be against specific criteria in a marking guide and formal feedback will be provided within ten days of the quiz. Verbal class-wide feedback will be given during the quiz review.

Course Learning Outcomes

- CL01 : Design and evaluate casing programs and casing strings;
- CL02 : Plan well trajectory;
- CL03 : Evaluate survey calculation methods;
- CL04 : Select proper wellbore direction and deviation control methods and tools.

Detailed Assessment Description

N/A

Assessment Length

1.5hrs

Assessment information

Guidelines for helping the preparation for the midterm quiz will be released on Moodle prior to the quiz.

Assignment submission Turnitin type

This is not a Turnitin assignment

Project

Assessment Overview

Design casing program for an extended reach development well. In the project, students are required to carry out literature survey, perform casing load analysis and casing program design through a case study. Final project report is required. Written and verbal feedback will be provided for each student and an individual mark will be issued against specific criteria in a marking guide.

Course Learning Outcomes

- CL01 : Design and evaluate casing programs and casing strings;
- CL02 : Plan well trajectory;

- CL03 : Evaluate survey calculation methods;
- CL04 : Select proper wellbore direction and deviation control methods and tools.

Detailed Assessment Description

N/A

Assessment Length

No more than 10 pages

Submission notes

Online submission

Assessment information

N/A

Assignment submission Turnitin type

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

Final Exam

Assessment Overview

Final exam covers all topics. Marking will be done with a rubric. Individual mark will be issued.

Course Learning Outcomes

- CL01 : Design and evaluate casing programs and casing strings;
- CL02 : Plan well trajectory;
- CL03 : Evaluate survey calculation methods;
- CL04 : Select proper wellbore direction and deviation control methods and tools.

Detailed Assessment Description

N/A

Assessment Length

2 hrs

Assessment information

Guidelines for helping the preparation for the final exam will be released on Moodle prior to the exam.

Assignment submission Turnitin type

Not Applicable

General Assessment Information

The assessment includes assignments, project, midterm quiz and final exam.

Grading Basis

Standard

Requirements to pass course

Students need to achieve at least 50 marks to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 20 May - 26 May	Reading	Self-study: Course outline
Week 1 : 27 May - 2 June	Lecture	Course Introduction; Casing Types and Physical Properties.
	Workshop	API casing classification
Week 2 : 3 June - 9 June	Lecture	Casing Performance Properties under Load Conditions
	Workshop	Load on casing
Week 3 : 10 June - 16 June	Online Activity	Principles of Casing Design - Casing Setting Depth & Program (This is a pre-recorded lecture due to the public holiday).
Week 4 : 17 June - 23 June	Lecture	Principles of Casing Design
	Workshop	Casing without liner
Week 5 : 24 June - 30 June	Lecture	Principles of Casing Design
	Workshop	Casing with liner, Review on Casing Design
Week 6 : 1 July - 7 July	Other	Flexibility week. Self-study: review for midterm quiz.
Week 7 : 8 July - 14 July	Lecture	Well Planning - Well trajectory
	Assessment	Midterm Exam: 1.5 hours
	Workshop	Well trajectory Casing Design in Deviated and Horizontal Wells
Week 8 : 15 July - 21 July	Lecture	Surveying Calculations
	Workshop	Survey Calculations
	Project	Casing Design in Deviated and Horizontal Wells
Week 9 : 22 July - 28 July	Lecture	Surveying Calculations, Surveying Methods & Tools
	Workshop	Surveying calculations
	Project	Casing Design in Deviated and Horizontal Wells
Week 10 : 29 July - 4 August	Lecture	Directional Control, MWD & Rotary Steerable System, Downhole Tools and Motors Final Review

Attendance Requirements

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

General Schedule Information

The course has weekly lectures; workshops in Week 7 to Week 10; midterm quiz in Week 7 and final exam in the exam period. Assignments are due in Week 3, 5, 7 and 9 respectively, project due in Week 10.

Course Resources

Prescribed Resources

Support material for this course including, whenever available, copies of lecture notes, lecture slides, recommended readings, etc. can be found on Moodle. The lecture notes/slides may be viewed and downloaded from the UNSW-Moodle <http://moodle.telt.unsw.edu.au/>.

Recommended Resources

Followings are the recommended books for this course:

- Rahman S.S. and Chilingarian G.V.: Casing Design Theory and Practice, Elsevier Science B.V., Amsterdam, The Netherlands, 1995
- Inglis, T.A.: Directional Drilling, Petroleum Engineering and Development Studies, Vol. 2, Graham & Trotman, 1987.
- Bourgoyne A.T. Jr., Millheim K.K., Chenevert M.E. and Young F.S. Jr.: Applied Drilling Engineering, SPE Textbook Series, Vol. 2, Richardson, TX, USA, 1991.

Additional Costs

N/A

Course Evaluation and Development

At the end of each course, all students will have the opportunity to complete a course evaluation form. These anonymous surveys help us understand your views of the course, your lecturers and the course materials. We are continuously improving our courses based on student feedback, and your perspective is valuable. Feedback is given via <https://student.unsw.edu.au/myExperience> and you will be notified when this is available for you to complete. We also encourage all students to share any feedback they have any time during the course - if you have a concern, please contact us immediately.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Zhixi Chen		211 Level 2, TETB	402962708	Office hours	No	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and policies. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off 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 website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

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.

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 an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

Course completion

Course completion requires submission of all assessment items. Failure to submit all assessment items may result in the award of an Unsatisfactory Failure (UF) grade for the Course unless special consideration has been submitted and approved.

Submission of Assessment Tasks

We encourage you to retain a copy of every assignment submitted for your own record, either in hardcopy or electronic form. All assessments must have an assessment cover sheet attached (if required).

Student Resources

The School has [student resources](#) section, containing useful advice and information to ensure you're able to focus on your studies.

Computing Resources and Internet Access Requirements

UNSW Minerals and Energy Resources Engineering provides blended learning using the online Moodle LMS (Learning Management System). Also see - Transitioning to Online Learning: www.covid19studyonline.unsw.edu.au

Note that some specialist engineering software is not available for Mac computers.

- Mining Engineering Students: OMB G48
- Petroleum Engineering Students: TETB LG34 & LG35

For more information about system requirements is available at www.student.unsw.edu.au/moodle-system-requirements

Accessing Course Materials Through Moodle

Course outlines, support materials are uploaded to Moodle, the university standard Learning Management System (LMS). In addition, on-line assignment submissions are made using the assignment dropbox facility provided in Moodle. All enrolled students are automatically included in Moodle for each course. To access these documents and other course resources, please visit: www.moodle.telt.unsw.edu.au

School Contact Information

School of Minerals and Energy Resources Engineering
Old Main Building, Level 1, 159 (K15)
UNSW SYDNEY NSW 2052 AUSTRALIA

For current students, all enquiries and assistance relating to enrolment, class registration, progression checks and other administrative matters, please see [The Nucleus: Student Hub](#).

Web & Important Links:

[School of Minerals and Energy Resources](#)

[The Nucleus Student Hub](#)

[Moodle](#)

[UNSW Handbook](#)

[UNSW Timetable](#)

[Student Wellbeing](#)

[Urgent Mental Health & Support](#)

[Equitable Learning Services](#)