UNSW Course Outline

PTRL5024 Drilling Fluids and Cementing Techniques - 2024

Published on the 27 Aug 2024

General Course Information

Course Code : PTRL5024
Year : 2024
Term : Term 3
Teaching Period : T3
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 drilling fluids and well cementing technology. The combined lectures, tutorials and laboratory experiments will provide students with a comprehensive understanding of the functions, composition and additives of drilling

fluids, clay and polymer chemistry and applications in drilling fluids, drilling fluid density determination and calculations, drilling fluid filtration and mud caking process, API drilling fluid properties, equipment and testing procedures, drilling fluid system design for control formation damage and wellbore stability, drilling fluid hydraulics and cuttings transportation, cement manufacture, composition and standardization, cement additives, cement slurry rheology properties, API cementing testing equipment and procedures, cement slurry design and calculations, mud removal by cement, gas migration, cementing equipment and procedures, post-job considerations and evaluation.

The course has a design project on mud program and cuttings transportation in deviated wells. As part of the project, students are required to carry out a literature survey on latest development in mud program and cuttings transportation in deviated wells; carry out a case study by designing a mud program, drilling hydraulics optimization and cuttings transportation in a deviated well.

Course Aims

The course aims to enable students to acquire fundamental knowledge of drilling fluids, drilling hydraulics and cementing technique and to apply the theory to the design, evaluation and optimization of drilling fluid program, drilling hydraulics and cementing operations. The course will reinforce students' understanding of the core aspects of well construction and the inter relationship between wellbore and reservoirs. The development of practical laboratory and professional skills through series of experimental work will help students preparing for their future careers in the industry.

Relationship to Other Courses

A drilling technology course following Well Drilling Equipment and operations

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the interactions of drilling fluids and cement slurry with formations and the related wellbore stability and formation damage mechanisms.
CLO2 : Design and evaluate drilling fluid program and cementing operations under specific well conditions
CLO3 : Apply API standards to prepare and test drilling fluids and cementing slurry
CLO4 : Calculate drilling fluid hydraulics for high rate of penetration and cuttings transportation efficiency

Course Learning Outcomes	Assessment Item
CLO1 : Describe the interactions of drilling fluids and cement slurry with formations and the related wellbore stability and formation damage mechanisms.	• Assignments • Laboratory • Midterm Exam • Final Exam
CLO2 : Design and evaluate drilling fluid program and cementing operations under specific well conditions	• Assignments • Laboratory • Midterm Exam • Final Exam
CLO3 : Apply API standards to prepare and test drilling fluids and cementing slurry	• Assignments • Laboratory • Midterm Exam • Final Exam
CLO4 : Calculate drilling fluid hydraulics for high rate of penetration and cuttings transportation efficiency	• Assignments • Laboratory • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360 | Blackboard Collaborate | Microsoft Teams

Learning and Teaching in this course

Face to face teaching mode in both lecturing and laboratory. The assessment contains assignments, class exercises, laboratory reports, midterm exam and final exam.

Other Professional Outcomes

https://www.unsw.edu.au/engineering/student-life/student-resources/program-design

Additional Course Information

The course contains both theoretical and practical components.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignments Assessment Format: Individual	25%	Due Date: Assignments due on weeks 3, 5, 9 and 10 respectively. Class exercises due weekly.
Laboratory Assessment Format: Group	10%	Due Date: Within two weeks after lab session
Midterm Exam Assessment Format: Individual	15%	Due Date: Week 7
Final Exam Assessment Format: Individual	50%	Due Date: Exam period

Assessment Details

Assignments

Assessment Overview

Assignments and project 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

- CLO1 : Describe the interactions of drilling fluids and cement slurry with formations and the related wellbore stability and formation damage mechanisms.
- CLO2 : Design and evaluate drilling fluid program and cementing operations under specific well conditions
- CLO3 : Apply API standards to prepare and test drilling fluids and cementing slurry
- CLO4 : Calculate drilling fluid hydraulics for high rate of penetration and cuttings transportation efficiency

Detailed Assessment Description

Assignments contain the following tpoics:

1. Mud composition and API properties, due on Week 3, feedback before *6 Oct 2024*
2. Mud weight calculations and API properties, due on Week 5
3. Drilling hydraulics and cuttings transportation, due on Week 9
4. Cementing calculations, due on Week 10

Assessment Length

No more than 10 pages

Submission notes

Online Moodle submission

Assessment information

N/A

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

N/A

Laboratory

Assessment Overview

Students will complete and submit lab report within two weeks of each lab session. Written and verbal feedback will be provided for each student and an individual mark will be issued against specific criteria in a marking guide. Verbal class-wide feedback will be given during the lab sessions.

Course Learning Outcomes

- CLO1 : Describe the interactions of drilling fluids and cement slurry with formations and the related wellbore stability and formation damage mechanisms.
- CLO2 : Design and evaluate drilling fluid program and cementing operations under specific well conditions

- CLO3 : Apply API standards to prepare and test drilling fluids and cementing slurry
- CLO4 : Calculate drilling fluid hydraulics for high rate of penetration and cuttings transportation efficiency

Detailed Assessment Description

Laboratory contains drilling fluids preparation and test. Laboratory attendance is compulsory, lab report is required within two weeks after each lab session. Assessment includes lab performance and lab report. Laboratory writing guide and assessment criteria will be provided in the laboratory induction.

Assessment Length

No more than 10 pages

Submission notes

Online Moodle Submission

Assessment information

N/A

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

N/A

Midterm Exam

Assessment Overview

The midterm exam 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 midterm exam. Verbal class-wide feedback will be given during the midterm exam review.

Course Learning Outcomes

- CLO1 : Describe the interactions of drilling fluids and cement slurry with formations and the related wellbore stability and formation damage mechanisms.
- CLO2 : Design and evaluate drilling fluid program and cementing operations under specific well conditions
- CLO3 : Apply API standards to prepare and test drilling fluids and cementing slurry

Detailed Assessment Description

The midterm exam covers lecture topics from W1 to W5. Guidelines for helping the preparation for mid-term quiz will be released prior to the quiz.

Assessment Length

`1.5 hrs

Assessment information

N/A

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

N/A

Final Exam

Assessment Overview

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

Course Learning Outcomes

- CLO1 : Describe the interactions of drilling fluids and cement slurry with formations and the related wellbore stability and formation damage mechanisms.
- CLO2 : Design and evaluate drilling fluid program and cementing operations under specific well conditions
- CLO3 : Apply API standards to prepare and test drilling fluids and cementing slurry
- CLO4 : Calculate drilling fluid hydraulics for high rate of penetration and cuttings transportation efficiency

Detailed Assessment Description

The Final Exam covers all the course contents. A two hours online quiz will be hold within the exam period. Guidelines for helping the preparation for the final exam will be released prior to the exam.

Assessment Length

2hrs

Assessment information

N/A

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

N/A

General Assessment Information

The assessment contains assignments, laboratory, midterm exam and final exam.

Attendance at laboratory sessions is compulsory. Students are encouraged to complete the "Laboratory Safety Awareness" and "Green Lab Environment Compliance" online courses before access to the lab.

Grading Basis

Standard

Requirements to pass course

Students need to achieve 50 marks to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 2 September - 8 September	Reading	Course outline
Week 1 : 9 September - 15 September	Lecture	Course introduction; Introduction to drilling fluids; Clay chemistry
	Workshop	Clay chemistry
Week 2 : 16 September - 22 September	Lecture	Clay chemistry; Polymer chemistry and its application in drilling fluid
	Workshop	Clay and polymer properties
Week 3 : 23 September - 29 September	Lecture	Polymer chemistry and its application in drilling fluid; Mud weight calculations
	Workshop	Mud weight calculations.
	Laboratory	Laboratory safety induction; Lab 1 - Mud preparation and test
Week 4 : 30 September - 6 October	Lecture	Drilling fluid filtration; API mud properties; API testing equipment and procedures; Chemical analysis
	Workshop	API mud properties
Week 5 : 7 October - 13 October	Lecture	Drilling fluid chemical analysis
	Workshop	Drilling fluid chemical analysis; Midterm Review
	Laboratory	Lab 2 - API mud properties
Week 6 : 14 October - 20 October	Other	Flexibility week
Week 7 : 21 October - 27 October	Lecture	Drilling hydraulics and cuttings transportation
	Assessment	Midterm Exam
	Laboratory	Lab 3 - Drilling Fluid Chemical Analysis A
Week 8 : 28 October - 3 November	Lecture	Drilling hydraulics and cuttings transportation; Cement manufacture, composition and hydration.
	Workshop	Drilling hydraulics and cuttings transportation
Week 9 : 4 November - 10 November	Lecture	Cement slurry properties and additives; Slurry design; Cement calculation.
	Workshop	Cementing calculation
	Laboratory	Lab 4 - Drilling Fluid Chemical Analysis B
Week 10 : 11 November - 17 November	Lecture	Gas migration, Cementing equipment; Cement placement and post job evaluation.
	Workshop	Final Review

Attendance Requirements

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

General Schedule Information

Lectures in Weeks 1-5 and 7-10.

Midterm Exam in Week 7.

Laboratory in Weeks 3, 5, 7, and 9.

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:• Ryen Caenn, HCH Darley, George R.Gray: Composition and Properties of Drilling and Completion Fluids, 7th edition, Gulf Professional Publishing, Elsevier, 2016.• 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.• Nelson, E.B. and Guillot D.: Well Cementing (Second Edition), Schlumberger, 2006.

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		TETB Level 2, 211	0402962708	Office hours	Yes	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 polices. 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 Plagarism

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: https://www.student.unsw.edu.au/transitioning-online-learning

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
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