

PTRL6029

Directional Horizontal and Multilateral Drilling

Term 2, 2023



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Zhixi Chen	zhixic@unsw.edu.au	Office hours	211 Level 2, TETB	0402 962 708

School Contact Information

School of Minerals and Energy Resources
Old Main Building, Level 1, 159 (K15)
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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](#)

Course Details

Units of Credit 6

Summary of the Course

Students in this course will learn about the application of deviated and multilateral wells, well planning and surveying, and methods and equipment used to monitor and maintain directional control. In doing so, students will gain a thorough understanding of the economic benefits and technical challenges associated with implementation of directional well technology. Course covers: Applications of directional, horizontal and multilateral wells. Planning and executing the drilling of directional, horizontal and multilateral wells. Planning of well trajectory. Graphical and analytical representations of Build & Hold and Build, Hold & Drop. Planning of well paths with single and multiple targets. Surveying methods, tools and calculations (tangential method, balanced tangential method, average-angle method, radius of curvature method, minimum curvature method, and Akgun/Kuru method). Drilling tools and methods. Selection of appropriate bottom-hole assembly and optimisation - slick BHA, single-and multi-stabiliser BHAs. Steerable Rotary Systems Downhole mud motors. Drilling and drill string considerations.

Course Aims

The course aims to enable students to acquire fundamental knowledge of directional, horizontal and multilateral drilling and to apply the theory to plan and optimize well trajectory and drilling operations. The course will reinforce students' understanding of the core aspects of well construction and the inter relationship between wellbore and reservoirs.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Plan and optimize well trajectory and drilling program	PE1.1, PE1.3, PE1.2, PE2.1, PE3.3
2. Perform trajectory surveying and survey calculations	PE1.1, PE1.2, PE1.3, PE2.1
3. Determine proper wellbore direction and deviation control methods and tools	PE1.3, PE2.1, PE3.3

Teaching Strategies

Distance mode

Lecture slides and lecture recordings will be available.

Online access to lectures.

Online support through Moodle.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Assignments	30%	Assignments due at the end of Weeks 3,7,10.	1, 2, 3
2. Online Quiz	10%	Week 7	1, 2, 3
3. Project	10%	Week 10	1, 2, 3
4. Final Exam	50%	Within the exam period.	1, 2, 3

Assessment 1: Assignments

Due date: Assignments due at the end of Weeks 3,7,10.

Assignments 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.

This is not a Turnitin assignment

Additional details

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

Assessment 2: Online Quiz

Assessment length: 1 hr

Due date: Week 7

The online quiz covers selected lecture topics. 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.

This is not a Turnitin assignment

Assessment 3: Project

Due date: Week 10

The project focuses on well trajectory design of an extended reach development well. In the project, students are required to carry out literature survey and perform well trajectory 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.

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

Additional details

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

Assessment 4: Final Exam

Assessment length: 2 hrs

Due date: Within the exam period.

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

This is not a Turnitin assignment

Additional details

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

Attendance Requirements

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

Course Schedule

[View class timetable](#)

Timetable

Date	Type	Content
O-Week: 22 May - 26 May		
Week 1: 29 May - 2 June	Topic	Ch-1 Introduction Ch-2 Well planning
Week 2: 5 June - 9 June	Topic	Ch-2 Well planning
Week 3: 12 June - 16 June	Topic	Ch-3 Survey Calculations
Week 4: 19 June - 23 June	Topic	Ch-3 Survey Calculations
Week 5: 26 June - 30 June	Topic	Ch-4 Surveying Methods & Tools
Week 6: 3 July - 7 July	Homework	Preparation for Midterm Quiz
Week 7: 10 July - 14 July	Topic	Ch-5 Directional Control
	Assessment	Midterm Quiz
Week 8: 17 July - 21 July	Topic	Ch-6 Drilling Tools and Methods, Rotary Steerable System
Week 9: 24 July - 28 July	Topic	Ch-7 Drilling & Drillstring Considerations
Week 10: 31 July - 4 August	Topic	Ch-8 Downhole Mud Motors

Resources

Prescribed Resources

Support material for this course including, whenever available, copies of lecture notes, recommended readings, etc. can be found on Moodle.

The lecture note 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:

- 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.

Course Evaluation and Development

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.

Submission of Assessment Tasks

The School has developed a guideline to help you when submitting a course assignment.

We encourage you to retain a copy of every assignment submitted for assessment for your own record either in hardcopy or electronic form.

All assessments must have an assessment cover sheet attached.

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.

Late Submission of an Assignment

Full marks for an assessment are only possible when an assessment is received by the due date. 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. 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 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, or
- Online quizzes where answers are released to students on completion, or Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or Pass/Fail assessment tasks.

We understand that at times you may not be able to submit an assignment on time, and the School will accommodate any fair and reasonable extension. We would recommend you review the UNSW Special Consideration guidelines – see section below.

Special Consideration

You may be eligible for special consideration, when an illness or other short-term events beyond your control (exceptional circumstances) affect your assessment performance. More details on special consideration can be found at: www.student.unsw.edu.au/special-consideration

We ask that you please contact the Course Convenor immediately once you have completed the special consideration application, no later than one week from submission.

Student Support

The University and the Faculty provide a wide range of support services for students, including:

- Library training and support services - www.library.unsw.edu.au
- Academic Skills Support - <https://www.student.unsw.edu.au/skills>
- Psychology and Wellness - www.counselling.unsw.edu.au

Equitable Learning Services aims to provide all students with a free and confidential service that provides practical support to ensure that your health condition doesn't adversely affect your studies. <https://student.unsw.edu.au/els>

Academic Honesty and Plagiarism

Your lecturer and the University will expect your submitted assignments are truly your own work. UNSW has very clear guidelines on what plagiarism is and how to avoid it. Plagiarism is using the words or ideas of others and presenting them 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. The University has adopted an educative approach to plagiarism and has developed a range of resources to support students. All the details on plagiarism, including some useful resources, can be found at www.student.unsw.edu.au/plagiarism.

All MERE students are required to complete a student declaration for academic integrity which is outlined in the assignment cover sheets. By signing this declaration, you agree that your work is your own original work.

If you need some additional support with your academic skills, please contact the Academic Skills Support or view some of the resources on their website: <https://www.student.unsw.edu.au/skills>. The Academic Skills Team can provide resources, support and assistance to help you improve your academic skills. Some students use the Centre services because they are finding their assignments a challenge, others because they want to improve an already successful academic performance.

Academic Information

Course Results

For details on UNSW assessment policy, please visit: www.student.unsw.edu.au/assessment

In some instances your final course result may be withheld and not released on the UNSW planned date. This is indicated by a course grade result of either:

- LE – indicates you have not completed one or more items of assessment; or
- WD – indicates there is an issue with one or more assignment; or
- WC – which indicates you have applied for Special Consideration due to illness or misadventure and the course results have not been finalised.

In either event it would be your responsibility to contact the Course Convener as soon as practicable but no later than five (5) days after release of the course result. If you don't contact the convener on time, you may be required to re-submit an assignment or re-sit the final exam and may result in you failing the course. You would also have a NC (course not completed) mark on your transcript and would need to re-enroll in the course.

Studying a course in the School of Minerals and Energy Resources Engineering at UNSW

Student Resources

This engineering [student resources](#) section collates 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 on-line Moodle LMS (Learning Management System). Also see - Transitioning to Online Learning: www.covid19studyonline.unsw.edu.au

It is essential that you have access to a PC or notebook computer. Mobile devices such as smart phones and tablets may compliment learning, but access to a PC or notebook computer is also required. Note that some specialist engineering software is not available for Mac computers.

- Mining Engineering Students: OMB G48
- Petroleum Engineering Students: TETB LG34 & LG 35

It is recommended that you have regular internet access to participate in forum discussion and group work. To run Moodle most effectively, you should have:

- broadband connection (256 kbit/sec or faster)

- ability to view streaming video (high or low definition UNSW TV options)

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

This course outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies.

How We Contact You

At times, the School or your course convenors may need to contact you about your course or your enrolment. Your course convenors will use the email function within Moodle or we will contact you on your @student.unsw.edu.au email address.

We understand that you may have an existing email account and would prefer for your UNSW emails to be redirected to your preferred account. Please see instructions on how to redirect your UNSW emails: ["How can I forward my emails to another account?"](#)

How You Can Contact Us

We are always ready to assist you with your inquiries. To ensure your question is directed to the correct person, please use the email address below for:

- Enrolment or other admin questions regarding your program: <https://unswinsight.microsoftcrmportals.com/web-forms/>
- Course inquiries should be directed to the Course Convenor

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	
PE2.3 Application of systematic engineering synthesis and design processes	
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	