PTRL4017

Well Technology

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
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Lecturers

Name	Email	Availability	Location	Phone
Sheik Rahman	sheik.rahman@unsw.edu.au	Office hours	212 Level 2, TETB	02 9385 5659

School Contact Information

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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

The course covers both the theory and practical applications of well design and well completion technology. The combined lectures, tutorials and laboratory experiments will provide students with a comprehensive understanding of the following aspects:

Well Design - prediction of formation pore pressure and stress gradients; determination of safety mud weight bounds for different in-situ stress conditions; design and planning well trajectory; surveying tools and methods; drilling methods and equipment for directional, horizontal and multilateral wells; design and evaluation of casing program under specific loading and downhole conditions.

Well Completion - well completion selection and design criteria; interval selection and productivity considerations; inflow performance and tubing performance analyses; tubing-packer movement and forces; tubing design; selection of downhole equipment, tubing accessories and wellhead equipment; basics of perforation, selection of equipment and procedure for perforating oil and gas wells; sand control and gravel packing.

Course Aims

The course aims to enable students to acquire fundamental knowledge of well systems design and well completion and to apply the theory to the design, evaluation and optimization of casing program, well trajectory and well completion. The course will reinforce students' understanding of the core aspects of well construction and well completion 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. Design and evaluate casing programs and casing strings;	PE2.2, PE3.2
2. Plan well trajectory;	PE2.2
3. Perform survey calculations;	PE2.2
4. Determine proper wellbore direction and deviation control methods and tools;	PE2.2, PE2.4, PE3.2
5. Understand well completion technology and well completion equipment;	PE1.1
6. Analyse well and tubing performance, tubing movement and design tubing string;	PE1.3
7. Design perforation and sand control for specific well conditions.	PE2.4, PE1.3

Teaching Strategies

1. Weekly lectures are designed to provide students fundamental understanding through a series of topics on well design and well completion.
2. The fundamental material covered in the lectures is supported by problem-solving exercises in tutorials and class discussions. The tutorial will also focus on supporting students for assessments.
3. Learning during lectures is further supported by computing laboratory practices. Students perform group-based lab experiments and group discussions and submit individual lab reports.
4. Online learning support is also available through LMS, including course material, lecture recordings, sample solution to tutorial questions and class works.
5. Exercises and quizzes at the end of each module will allow students to self-assess their understanding of key concepts.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Assignments	20%	Assignments due at the end of Weeks 3, 7, 8, 10 respectively.	1, 2, 3, 4, 5, 6, 7
2. Midterm Exam	30%	Midterm quiz due in Week 7; Tutorial exercises due weekly.	1, 2, 3, 4, 5, 6, 7
3. Final Exam	50%	During the Exam Period	1, 2, 3, 4, 5, 6, 7

Assessment 1: Assignments

Due date: Assignments due at the end of Weeks 3, 7, 8, 10 respectively.

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: Midterm Exam

Due date: Midterm quiz due in Week 7; Tutorial exercises due weekly.

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

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

Assessment 3: Final Exam

Due date: During the Exam Period

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

Additional details

Guidelines for helping the preparation for the final exam will be released on Moodle 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	Lecture	Course Introduction Lecture Part A: Casing Types and Physical Properties Lecture Part B: Well Completion Design, Well Performance Analysis
	Tutorial	Part A: API casing classification Part B: Well Performance Analysis
Week 2: 5 June - 9 June	Lecture	Part A: Casing Performance Properties under Load Conditions Part B: Well Performance Analysis
	Tutorial	Part A: Load on casing Part B: IPR curve for oil reservoir
Week 3: 12 June - 16 June	Lecture	Part A: Principles of Casing Design - Casing Setting Depth & Program (This is a pre-recorded lecture due to the public holiday). Part B: Well Performance Analysis
	Tutorial	Part A: Casing setting depth & program Part B: Production index, IPR curve for gas reservoir
Week 4: 19 June - 23 June	Lecture	Part A: Principles of Casing Design Part B:Tubing Performance Analysis, Pressure Gradient Analysis
	Tutorial	Part A: Casing without liner

		Part B: Pressure gradient calculation
Week 5: 26 June - 30 June	Lecture	Part A: Principles of Casing Design Part B: Tubing Performance Analysis, Pressure Gradient Analysis
	Tutorial	Part A: Casing with liner, Review on Casing Design Part B: Pressure Gradient calculation, Review on Well and Tubing performance Analysis
	Tut-Lab	Computer Lab: VirtuWell • Pressure gradient analysis • IPR/TPC analysis
Week 6: 3 July - 7 July	Homework	Flexibility week
Week 7: 10 July - 14 July	Lecture	Part A: Well Planning Part B: Tubing Movement & Tubing Design
	Assessment	Midterm Exam: 2 hours
	Tutorial	Part A: Well Trajectory Design
	Tut-Lab	Computer Lab: VirtuWell • Pressure gradient analysis • IPR/TPC analysis
Week 8: 17 July - 21 July	Lecture	Part A: Surveying Calculations Part B: Well completion Equipment
	Tutorial	Part A: Survey Calculations Part B: Tubing movement calculation
Week 9: 24 July - 28 July	Lecture	Part A: Surveying Calculations, Surveying Methods & Tools Part B: Perforation of Oil and Gas Wells
	Tutorial	Part A: Surveying calculations Part B: Perforation Design
Week 10: 31 July - 4 August	Lecture	Part A: Directional Control, MWD & Rotary Steerable System, Downhole Tools and Motors Part B: Sand Control

	Tutorial	Part A: Final Review Part B: Determination of Gravel and Liner Slot Size, Final Review

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.
- Buzarde L.E. Jr., R.L. Kastro, W.T. Bell and C.L. DePriester: Production operations, Course 1, Well Completions SPE Publications, 1972
- Allen T.O. and A.P. Roberts: Production Operations, Volumes I and II, Oil and Gas Consultants International Inc, 1989
- Reservoir Engineering Hand Book, Tarek Ahmed Gulf Publishing Company, 2000
- Michael J Economides, A Daniel Hill, Christine Ehlig Economides and Englewood Cliffs NJ.: Petroleum Production Systems, Prentice Hall 1994.

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.

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

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CRICOS

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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	