School of Minerals and Energy Resources Engineering

1 INFORMATION ABOUT THE COURSE

Course Code:	PTRL6027	Term:	T1, 2020	Level:	PG	Units/Credits	6 UOC
Course Name:	Casing Design & Cementing						

Course Convenor:			
Contact Details	School of Minerals and Energy Resources Engineering TETB 211	EMAIL:	zhixic@unsw.edu.au
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Contact times	Distance Delivery		

1.1 Course Description

The course covers:
Casing Design - API properties of casing and casing couplings; performance properties of casing under load conditions; principles of casing design for vertical, deviated and horizontal wells; preparation of casing programs for different well types; optimisation of casing program.
Cementing ς Cement manufacture, composition and standardization; measuring and controlling cement properties; cement additives; cement slurry design; Cementing calculations - Primary cementing, plug balancing, and squeeze cementing; rheology and types of flow; mechanism of mud removal by cement; cementing equipment; planning, conducting and monitoring primary and secondary cementing jobs; post-job considerations and evaluation.

1.2 Course Completion

Course completion requires submission of all assessment items; failure to submit all assessment items can result in the award of an Unsatisfactory Failure (UF) grade for the Course.

1.3 Assumed Knowledge

Prerequisite: N/A

1.4 Attendance

This course is delivered in distance mode.

2 AIMS, LEARNING OUTCOMES AND GRADUATE ATTRIBUTES

2.1 Course Aims

This course will enable students to acquire fundamental knowledge of casing design and cementing operations and to apply the theory to the design, evaluation and optimization of casing program and cementing operations.

2.2 Learning Outcomes

At the conclusion of this course, students should be able to:

1. Design and evaluate casing program for specific well conditions.
2. Design and evaluate cementing operations for specific well conditions.
3. Prepare and test cementing slurry and set cement according to API standards.

3 REFERENCE RESOURCES

3.1 Reference Materials

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/.

3.2 Recommended Materials

Followings are the recommended books for Casing Design:

Rahman S.S. and Chilingarian G.V.: Casing Design Theory and Practice. Elsevier Science B.V., Amsterdam, The Netherlands, 1995.

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.

The textbook for Cementing is:
Nelson, E.B. and Guillot D., Well Cementing (Second Edition), Schlumberger, 2006.
It is important that you have a copy of the above textbook as there is no separate course manual for Cementing. The book can be available from the following links:
https://www.amazon.com/Well-Cementing-

4 COURSE CONTENT AND LEARNING ACTIVITIES

4.1 Course content

1) Casing types and casing physical properties
2) Casing performance under load conditions
3) Principles of casing design
4) Chemistry and characterization of Portland cement
5) Cement calculations and cement properties
6) Mud removal, cement ς formation interaction and annular fluid migration
7) Cementing equipment and techniques
8) Cement job evaluation

4.2 Learning Activities Summary

UNSW Wk	Activity	Content
1	Distance delivery	Casing Notes Ch-1: Casing types Casing Notes Ch-2: Casing physical properties
2	Distance delivery	Casing Notes Ch-3: Performance Properties of Casing Under Load Conditions
3	Distance delivery	Casing Notes Ch-3: Performance Properties of Casing Under Load Conditions Casing Notes Ch-4: Principles of Casing Design
4	Distance delivery	

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7.9 Students Needing Additional Support

The Student Equity and Disabilities Unit (SEADU) aims to provide all students with support and professional advice when circumstances may prevent students from achieving a successful university education. Take a look at their webpage: www.studentequity.unsw.edu.au/

7.10 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.

9.1.5 Appendix C Cementing Calculations

Reading Requirements (0.75 week):

Introduction, pp. 659;

Cement-slurry properties, pp. 659 ς 664;

Primary cementing calculations, pp. 664 ς 668;

Plug balancing, pp. 668 ς 670;

C-5 Squeeze cementing, pp. 670 ς 672.

9.1.6 Review Questions:

1. Calculate the slurry density and yield, given:

Water content = 40 % (BWOC) One sack cement = 1 cu ft = 94 lb

Absolute volume of cement = 0.0380 gal/lbm

Density of water = 8.34 lb/gal

2. Given well and cementing0.0Q EMC /P <</MC=a a0.000008872 0 595.38 841.98 reW*nBT/F5 12 Tf1 0 0 1 26

9.1.7 Chapter 4 Rheology and Flow of Well Cement Slurries Required Readings

Reading Requirements (0.5 weeks):

4-1

9.1.9

9.1.13 Chapter 8 Mechanical Properties of Well Cements Required Readings

Reading Requirements (0.25 weeks):

8-1 Introduction, pp. 269;

8-4 Mechanical behaviour of a cement cased wellbore, pp. 280 ς 287; 8-5 Guidelines for cement design, pp. 287.

9.1.14 Chapter 8 - Review Questions:

1. How does the change in wellbore pressure/temperature affect the cement cased wellbore?

2. How do tectonics, subsidence and formation creep affect the cement cased wellbore?

3. What are the general procedures for cement design?

9.1.15 Chapter 9 Annular Formation Fluid Migration Reading Requirements

Reading Requirements (0.5 weeks):

9-1 Introduction, pp. 289;

9-2 Practical consequences of gas migration, pp. 289 ς 290; 9-3 Physical process of gas migration, pp. 290 ς 299;

9-6 Practical solutions for combating gas migration, pp.305 ς 310.

9.1.16 Chapter 9 - Review Questions:

1. What are the causes of short-term and long term gas migration?

2. What are the factors affecting gas migration?

3. How to prevent short term gas migration?

4. How to predict and combat gas migration?

9.1.17 Chapter 11 Cementing Equipment and Casing Hardware Reading Requirements

Reading Requirements (0.5 weeks):

Cementing materials, pp. 343 ς 344;

Basic equipment, pp. 344 ς 358;

Cementing units, pp. 359 ς 362;

Introduction to casing hardware, pp.362; 11-5 Casing hardware, pp. 362 ς 397;

11-6 Liners, pp. 397 ς 419;

11-7 Remedial cementing tools, pp. 421 -429.

9.1.18 Chapter 11 - Review Questions:

-plug cement work?

cementing?

9.1.19 Chapter 13 Primary Cementing Techniques Reading Requirements

Reading Requirements (0.5 weeks):

13-1 Introduction, pp. 459;

13-2 Classification of casing strings, pp. 459 ς 466;

13-3 Cement placement procedures, pp. 466 - 474;

13-4 Liners, pp. 475 ς 484.

13-7 Operational considerations, pp. 495 ς 500.

9.1.20 Chapter 13 - Review Questions:

1. Describe the single-stage-cementing operations.

2. Describe the continuous two-stage cementing technique.

3. What are the common industry misconceptions about liner reciprocation and/or rotations?

4. When do we normally run tieback liners?

5. What are operational considerations that should be taken into account during the planning stage of primary cementing?

9.1.21 Chapter 14 Remedial Cementing Reading Requirements

Reading Requirements (0.5 weeks):

Introduction, pp. 503;

Problem identification ς Well problems cured by remedial cementing, pp. 505 -512;

Plug cementing ς Tools and techniques, pp. 512 ς 515;

Plug cementing ς Placement, pp. 515 ς 520;

Plug cementing ς Cement ςslurry design, pp. 520 ς 521;

Cement ςplug evaluation, pp. 521;

14-7 Squeeze cementing ς Introduction, pp. 521;

14-9 Squeeze cementing tools and techniques, pp. 525 ς 532;

Basic squeeze-job procedures, pp. 538 ς 540.

Monitoring squeeze jobs, pp. 540;

Cleanup after a squeeze job, pp. 540 ς 541;

Squeeze job evaluation, pp. 541 ς 532;

14-17 Reasons for squeeze cementing failures, pp. 542 - 543.