

교과목번호 Course No.	M1594.00 2100	강좌번호	-	Title	저류층 지오메카닉스 Reservoir Geomechanics	credit	3
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강의목표 Objective	<p>본 강좌에서는 석유 가스 공학, 지하에너지저장, 지열에너지 및 기타 에너지자원공학 분야의 저류층 개발을 위해 필수적인 지오메카닉스의 기본 원리를 학습한다. 암석의 탄성적 및 소성적 성질에 대한 기본 사항 외에 저류층에서의 현지응력 산정, 임계응력하의 균열과 유체유동, 공벽안정 해석, 수리역학적 상호연동해석, 수압파쇄, 저류층 침하, 유체주입 및 생산에 따른 유발지진 등을 학습한다. 또한 셰일가스 등 비전통에너지 개발에 핵심적인 지오메카닉스 응용 기술을 소개한다. 저류층 지오메카닉스의 기본원리와 현장에서의 다양한 응용 사례를 동시에 학습하여 산업현장과 연구개발에 응용할 수 있는 능력을 함양하는데 주안점을 둔다.</p> <p>This course deals with fundamentals of geomechanics that is essential for reservoir engineering related to oil and gas engineering, underground storage of energy, geothermal energy and other energy resources engineering. This course covers the basics of elastic and plastic properties of rock, estimation of in situ stress, critically stress faults and fluid flow, wellbore stability, coupled hydromechanics, hydraulic fracturing, reservoir subsidence and injection- and depletion- induced seismicity. In particular, applied geomechanics techniques used for unconventional resources such as shale gas are introduced. This course emphasizes the ability to apply the knowledge of geomechanics to industry and research applications by balanced coverage of fundamentals and real-world problems associated with reservoir geomechanics.</p>
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교재 Textbook and references	<ul style="list-style-type: none"> <li>- Zoback MD, 2007, Reservoir Geomechanics, Cambridge University Press (main textbook) access: <a href="https://ebookcentral.proquest.com/lib/snulibrary-ebooks/detail.action?docID=1357380">https://ebookcentral.proquest.com/lib/snulibrary-ebooks/detail.action?docID=1357380</a> : can be viewed with limited downloadable pages</li> <li>- Zoback MD, Kohli AH, 2019, Unconventional Reservoir Geomechanics, Cambridge University Press</li> <li>- Cornet FH, 2015, Elements of Crustal Geomechanics, Cambridge Univ Press</li> </ul>
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평가방법 Evaluation	Participation	Homework	Mid-term Exam	Final Exam
	10 %	30 %	30 %	30 %
	비고			

수강생 참고사항 Note to the students	<ul style="list-style-type: none"> <li>- 본 강좌는 에너지자원공학과 전공 선택과목임 (3학년 혹은 4학년).</li> <li>- 2020학년도는 코로나 바이러스 관계로 일부 수업은 온라인 강의로 진행됨</li> <li>- 조교: 유화정 (38-324호, 7232, <a href="mailto:yhj0313@snu.ac.kr">yhj0313@snu.ac.kr</a>), 임주휘 (153-518호, 8713, <a href="mailto:dlawngnl1992@snu.ac.kr">dlawngnl1992@snu.ac.kr</a>)</li> <li>- This course is elective for the department of energy resources engineering.</li> <li>- Part of the lectures are given through online.</li> <li>- teaching assistants: Hwajung Yoo (38-324, 7232, <a href="mailto:yhj0313@snu.ac.kr">yhj0313@snu.ac.kr</a>), Juhui Yim (153-518, 8713, <a href="mailto:dlawngnl1992@snu.ac.kr">dlawngnl1992@snu.ac.kr</a> )</li> </ul> <p style="text-align: right;">Syllabus last updated: 13 May 2020</p>
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부정행위자에 대한 처리 Note about Plagiarism	<ul style="list-style-type: none"> <li>- 부정행위자는 학칙에 따라 조치함.</li> <li>- Plagiarism is strictly prohibited.</li> </ul>
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강의 계획 Schedule	주간	강의내용 (Course content)	Online/classroom	Textbook
	week 1 (3/16, 18)	- Introduction - Applications of Reservoir Geomechanics	edX Stanford University Online: Reservoir Geomechanics: Unit 1	Overview (ch.1-ch.12)
	week 2 (3/23, 25)	- Fundamentals of Geomechanics/Poroelasticity	SNUON. Geothermal Energy Unit.13 & Unit.14	ch.3 ch.4
	week 3 (3/30, 4/1)	- Introduction to the Course - Tectonic stress field and its determination	on-line lecture	ch.1 ch.9
	week 4 (4/6, 8)	- Pore pressure at depth - Basic Constitutive law & Rock Failure	on-line lecture	ch.2 ch.3-4
	week 5 (4/13)	- Rock Failure	on-line lecture	ch.4
	week 6 (4/20, 22)	- Rock Failure - Fault and fracture at depth	on-line lecture	ch.4 ch.5
	week 7 (4/27, 29)	- Compressive and tensile failure in vertical wells	on-line lecture	ch.6
	week 8 (5/4, 6)	- Determination of S3 from mini-fracs - Wellbore failure/stress determination in deviated wells	on-line lecture	ch.7 ch.8
	week 9 (5/11, 13)	- Wellbore stability	on-line lecture	ch.10
	week 10 (5/18, 20)	- Critically stress faults and fluid flow - Reservoir Depletion and subsidence	on-line lecture	ch.11 ch.12
	week 11 (5/25, 27)	- Reservoir Depletion and subsidence - Hydraulic Fracturing	on-line lecture	ch.12 (UG: ch.8)
	week 12 (6/1, 3)	- Hydraulic Fracturing	on-line lecture	(UG: ch.10, 11)
	week 13 (6/8, 10)	- Induced Seismicity	on-line lecture	(UG: ch.9, 13, 14)
	week 14 (6/15, 17)	- Unconventional resources & Outstanding Issues - Final Exam (Open book and paper)	on-line lecture Classroom	

※ Stanford University, edX, Reservoir Geomechanics (You need to register)

<https://courses.edx.org/courses/course-v1:StanfordOnline+GEOPHYSX0001+1T2020/course/>

Unit 1: Course Overview (Overview of the textbook, Zoback, 2007)

- Section 1 - Course Overview
- Section 2 - Overview of Units 2, 3                      ch.2-3
- Section 3 - Overview of Units 4-8                      ch.4-8
- Section 4 - Overview of Units 9-17                      ch.9-17
- Section 5 - Overview of Units 18-20                      ch.18-20

※ SNUON Geothermal Energy: <http://etl.snu.ac.kr/course/view.php?id=171232>

Unit 13. Reservoir Geomechanics (1)

- Introduction to reservoir geomechanics
- Fundamentals: stress and force
- Fundamentals: stress transformation
- Fundamentals: Mohr's circle
- Fundamentals: constitutive equation

Unit 14. Reservoir Geomechanics (2)

- Fundamentals: governing equation
- Fundamentals: basics of rock mechanics
- Fundamentals: failure criterion
- Fundamentals: In situ stress