Identification	**Subject**	PETE 302 Drilling Engineering 6 ECTS
	Department	Petroleum Engineering
	Program	Undergraduate
	Term	Fall, 2025
	Instructor	Kanan Mammadov
	E-mail:	kanan.mammadov@khazar.org
Prerequisites	Algebra, Basic Calculus, Solid Mechanics, Fluid Mechanics, General Chemistry, Geology	
Language	English	
Compulsory/Elective	Compulsory	
Required textbooks and course materials	***Textbook:*** — *Drilling Engineering: Author Dr. John Ford, Heriot-Watt University, Department of Petroleum Engineering, Edinburgh, UK-2013* — *Well Engineering and Construction: Hussain Rabia, Entrac Consulting-2002* — *Baker Hughes INTEQ, Drilling Engineering Workbook, A Distributed Learning Course-1995* — *Managed Pressure Drilling: Bill Rehm, Jerome Schubers, Arash Haghshenas, Amir Saman Paknejad and Jim Hughes-2008, Gulf Publishing Company, Houston, Texas.*	
Course website	n/a	
Course outline	This course provides a comprehensive introduction to drilling engineering, addressing the fundamental concepts, equipment, and practices used in the drilling of oil and gas wells. Students will gain insight into both land and offshore drilling operations, the engineering principles behind well construction, and the decision-making processes required to ensure safe and efficient drilling activities. The course begins with an overview of drilling rigs, their classification, and major components, emphasizing the functions of power, hoisting, rotary, circulation, and well control systems. Students will learn about the drilling string, drill bits, and associated tools that enable the mechanical penetration of subsurface formations. The course also covers drilling fluids, their properties, and their critical roles in cooling, cleaning, and controlling the well. Key engineering concepts such as formation pressures, pore pressure prediction, and well control practices are explored, including the use of blowout preventers and kick detection methods. Casing and cementing operations are introduced to illustrate how well integrity and zonal isolation are achieved. Drilling hydraulics, equivalent circulating density, and hole cleaning challenges are presented in the context of maintaining operational safety and efficiency. Modern drilling practices are discussed, including directional drilling, measurement-while-drilling (MWD), and logging-while-drilling (LWD), which enable precise wellbore placement. The course also introduces offshore drilling and subsea systems, highlighting the unique challenges of deepwater operations. Special attention is given to well planning, risk assessment, and cost analysis as integral parts of drilling project management. Advanced topics such as managed pressure drilling (MPD), automation, and digitalization in drilling are presented to familiarize students with cutting-edge technologies shaping the future of the industry. The course concludes with a review of common drilling problems, troubleshooting strategies, and best practices derived from real-world case studies.	

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<tr><td></td><td colspan="3">By integrating engineering principles with practical applications, the course aims to develop students' ability to understand drilling operations, evaluate equipment and processes, and appreciate the role of safety, teamwork, and innovation in modern well construction.</td></tr>
<tr><td>Course objectives</td><td colspan="3">▪ Provide overview of modern drilling engineering industry
▪ Provide skillful understanding of drilling engineering theory
▪ Perform basic well planning and operations related calculations</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">By the end of the course the students should be able to gain or improve the following skills:

▪ Ability to discuss the Drilling Operations, Rig Components, Formation Pressures, Well Control, Casing, Cementing, Drilling Fluids, Hydraulics, Directional Drilling, Directional Surveying, Measurement While Drilling and Subsea Drilling
▪ Teamwork
▪ Decision Making</td></tr>
<tr><td rowspan="6">Teaching methods</td><td colspan="2">Lecture</td><td>x</td></tr>
<tr><td colspan="2">Group assignment</td><td>x</td></tr>
<tr><td colspan="2">Simulation</td><td>x</td></tr>
<tr><td colspan="2">Case analysis</td><td>x</td></tr>
<tr><td colspan="2">Others</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="7">Evaluation</td><td>Methods</td><td>Date/deadlines</td><td>Percentage (%)</td></tr>
<tr><td>Midterm Exam</td><td></td><td>30</td></tr>
<tr><td>Class Participation</td><td></td><td>15</td></tr>
<tr><td>Project</td><td></td><td>15</td></tr>
<tr><td>Final Exam</td><td></td><td>40</td></tr>
<tr><td>Others</td><td></td><td></td></tr>
<tr><td>Total</td><td></td><td>100</td></tr>
<tr><td>Policy</td><td colspan="3">• Quizzes will be provided during the classes, and they are to be based on the topic covered during the classes. Random quizzes during semester are for the instructor to decide the eligibility of student for the semester project.
• Group based practical project is going to be given in order to illustrate the practical significance of the theory taught in the classes. The project represents a collective endeavor undertaken by students within the realm of scientific inquiry. The incorporation of this project into the curriculum serves the dual purpose of showcasing the subject's research endeavors to potential students and illuminating the ongoing scholarly activities within the field.
• Midterm will be carried out in the week announced by the university. Time allocated will be announced close to the midterm. Its primary objective is to provide students with a clearer assessment of their progress within the course, enabling them to gauge their performance and understanding up to that point.
• Final exam date and time will be defined by the University. A final examination is an evaluative assessment presented to students at the conclusion of an academic term or course of study. This assessment typically consists of a predefined set of questions or exercises designed to gauge students' proficiency and comprehension of the subject matter.
• NO CELL PHONES are allowed during lecture. PLEASE turn them off</td></tr>
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	before lecture! (Not silent or vibrating mode). This is a university policy and accepted by the department of PE, and violators will be reprimanded accordingly. • **Participation and interaction in classes are more important than just attendance.** • No late tasks/homework will be accepted. Homework is to be completed on an individual basis. Students may discuss homework with classmates, but students are responsible for their own work. If students have consulted classmates, please note the individuals name on the top of students' assignment. • No late assignments will be accepted without prior arrangement with the instructor for acceptable excuses. Medical and family emergency will be considered on case-by-case basis. Note that inability to participate in quiz or presentations will not be accepted, and YOU WILL NOT HAVE A SECOND CHANCE TO PRESENT YOUR RESULTS OR PARTICIPATE IN QUIZZES. IN CASE OF ABSENCE, YOU WILL HAVE TO PRESENT "ARAYIŞ" TO THE INSTRUCTOR. • Quizzes may be given unannounced throughout the term. • There will be no make-up quizzes. • No make-up exams. If students miss an exam, a zero score will be assigned to the missed exam. • If students should miss class due to personal emergency or medical reasons, please notify the instructor by email immediately. A doctor's note will be required for make-up work. • Students are responsible for completing the reading assigned from the textbook related to the covered topics and for checking email regularly for important information and announcements related to the course. • Any form of plagiarism or cheating on a proposal, work plan, bibliography, presentation of literature review, final report will result in the cancellation of the work. In this case, the student will receive a mark of 0 without any further consideration. After identification cheating or plagiarism, NO CHANCE will be given for correction and rewrite report. • University policy on academic honesty concerning exams and individual work will be strictly enforced.

Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook/Assignments

1		Overview of Drilling Operations (drilling personnel, rotary drilling equipment, the drilling process, offshore drilling)	HW Drilling Ch. 1
2		Rig Components (power system, circulating system, rotary system, well control system, hoisting system, well monitoring system)	HW Drilling Ch. 2
3		The Drill string (power system, hoisting system, circulating system, rotary system, well control system and well monitoring system)	HW Drilling Ch. 3
4		Drilling Bits (types of drilling bit, bit design, bit selection, rock bit evaluation, bit performance)	HW Drilling Ch. 4
5		Formation Pressures (formation pressures, overburden pressures, origin of abnormal pressure, drilling problems associated with abnormal formation pressures, transition zone, prediction and detection of abnormal pressures, formation fracture gradient)	HW Drilling Ch. 5
6		Well Control (primary control, warning signs of kicks, secondary control, well killing procedures)	HW Drilling Ch. 6
7		**Mid-term Exam**	
8		Casing (Component parts of a casing string, casing terminology, properties of casing, API specifications, standards and bulletins, wellheads and casing hangers, rig-site operations, casing design)	HW Drilling Ch. 7
9		Cementing (oil well cements, properties of cement, cement additives, primary cementing, squeeze cementing, cement plugs, evaluation of cement jobs)	HW Drilling Ch. 8
10		Drilling Fluids (field tests on drilling fluids, water-based mud, oil-based muds, solids control)	HW Drilling Ch. 9
11		Hydraulics (flow regime and Reynolds number, rheological models, frictional pressure drop in pipes and annuli, frictional pressure drop across the bit, optimising the hydraulics of the circulating system)	HW Drilling Ch. 10
12		Directional Drilling (applications, depth reference and geographical reference systems, profile planning, considerations when planning the directional well path, deflection tools)	HW Drilling Ch. 11
13		Directional Surveying (surveying calculations, survey calculations and plotting results, photographic surveying tools, downhole telemetry tools, inertial navigation systems), MWD	HW Drilling Ch. 12,13
14		**Group Project Presentations**	
15		**Mock Exam, Final Consultation**	
	TBC	**Final Exam**	

This syllabus is a guide for the course and any modifications to it will be announced in advance.