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|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Identification</b>                          | <b>Subject</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Well Logging - PETE 312 - 6 ECTS                                                                                                                            |
|                                                | <b>Department</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Petroleum Engineering                                                                                                                                       |
|                                                | <b>Program</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Undergraduate                                                                                                                                               |
|                                                | <b>Term</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Fall, 2026                                                                                                                                                  |
|                                                | <b>Instructor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Leyla Alimuradova                                                                                                                                           |
|                                                | <b>E-mail:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <a href="mailto:leyla.alimuradova@gmail.com">leyla.alimuradova@gmail.com</a> <a href="mailto:leyla.alimuradova@khazar.org">leyla.alimuradova@khazar.org</a> |
|                                                | <b>Phone:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |
|                                                | <b>Classroom/hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 41 Mehseti str. (Neftchilar campus), Saturday                                                                                                               |
|                                                | <b>Office hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Friday, 15:00 - 17:00                                                                                                                                       |
| <b>Prerequisites</b>                           | General Geology (GEOL203)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                             |
| <b>Language</b>                                | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                             |
| <b>Compulsory/Elective</b>                     | Elective                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                             |
| <b>Required textbooks and course materials</b> | <ol style="list-style-type: none"> <li><b>1. Dr. Paul W.J. Glower, 2010. "Petrophysics MSc Course Notes", MSc Petroleum Geology Department of Geology and Petroleum Geology University of Aberdeen UK,</b></li> <li><b>2. Djebbar Tiab, Erle C. Donaldson, 2010. "Petrophysics", Elsevier.</b></li> <li><b>3. Gary Mavko, Tapan Mukerji, Jack Dvorkin, 2009 "The Rock Physics Handbook",</b></li> <li><b>4. Nnaemeka Ezekwe, 2011, "Petroleum reservoir engineering practice", Prentice Hall.</b></li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                             |
| <b>Course description</b>                      | <p>This course is designed for the bachelor and master students to study the properties of rocks and their interaction with fluids (gases, liquid hydrocarbons, and formation aqueous solutions). Course address's introduction to the basic hydrocarbon reservoir formation evaluation using open-hole logs (resistivity (micro and focused), gamma ray, self-potential, caliper, density neutron, sonic, cement bond and variable density), laboratory (core) and field measurements data and geological information.</p> <p>The well logging course will essentially deal with geological strata identification and the determination of physical properties of petroleum fluids and reservoir rocks as well as includes the determination of the lithology of hydrocarbon reservoirs; rocks porosity, permeability, and fluids saturation distribution in hydrocarbon reservoirs.</p>                                                                                                                                                                                                                    |                                                                                                                                                             |
| <b>Course objectives</b>                       | <p><i>Basic Objective of the Course:</i></p> <ul style="list-style-type: none"> <li>▪ To equip students with the core concepts, methods, and techniques of well logging and interpretation.</li> <li>▪ To prepare students for the industry environment</li> </ul> <p><i>Specific Objectives of the Course:</i></p> <ul style="list-style-type: none"> <li>▪ To support the students academically, to improve their chance of realizing their potential.</li> <li>▪ To give basic knowledge in geology and physics is required to understand petrophysical models.</li> <li>▪ To encourage students' participation and interaction and fostering atmosphere of tolerance and respect</li> <li>▪ To develop an understanding of the theory and practice of managerial analysis, and strategic decision making</li> <li>▪ To develop an understanding of the theory in Well logging</li> <li>▪ To furnish of students with the "Interpretation charts"</li> <li>▪ To build background for the students further Well logging interpretation</li> <li>▪ To introduce the key concepts of rock physics</li> </ul> |                                                                                                                                                             |
| <b>Learning outcomes</b>                       | <p><b>By the end of the course the students should be able:</b></p> <ul style="list-style-type: none"> <li>▪ Perform quick look interpretation of logs.</li> <li>▪ Perform log interpretation of real case studies.</li> <li>▪ Calculate field reserves.</li> <li>▪ Use well-to-well correlations of logs to identify geological signatures of formations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                             |

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|                         | <ul style="list-style-type: none"> <li>Understand the math and physics behind each measurement technique and rock physics models.</li> <li>Evaluate elastic properties from log data and apply them to drilling and reservoir stimulation.</li> <li>Identify rock facies using velocity transforms.</li> <li>Build Rock Physics models for sandstone formations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |                       |
| <b>Teaching methods</b> | <b>Lecture</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       | x                     |
|                         | <b>Group discussion</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       | x                     |
|                         | <b>Practical exercises</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                       | x                     |
|                         | <b>Simulation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |                       |
|                         | <b>Case analysis</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       | x                     |
|                         | <b>Course paper</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |                       |
|                         | <b>Others</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |                       |
| <b>Evaluation</b>       | <b>Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Date/deadlines</b> | <b>Percentage (%)</b> |
|                         | <b>Midterm Exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       | 30                    |
|                         | <b>Class Participation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                       | 5                     |
|                         | <b>Assignments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | 10                    |
|                         | <b>Quizzes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       | 5                     |
|                         | <b>Projects</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                       | 10                    |
|                         | <b>Final Exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       | 40                    |
|                         | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       | 100                   |
| <b>Class Policy</b>     | <ul style="list-style-type: none"> <li><b>Quiz</b><br/>Each quiz will consist of 5 questions, and each question will be marked with 1 point. One quiz will be organized in the middle of the first semester and the midterm exam. The second quiz will be organized between the midterm exam and the final exam.</li> <li><b>Mini project</b><br/>The mini project must consist of an abstract, introduction, objectives, methodology, results, discussion, conclusion, and references. The report must be no longer than 7-10 pages of A4 in portrait orientation, with a title and text size set to Arial 12. The mini project must be presented. The mini-project report and presentation marks will be summarized and divided by 2 to obtain an average mark.</li> <li><b>Activity</b><br/>The students should participate in seminars, conferences, and other events related to their courses to build new connections between academic and non-academic institutions. By 10 May 2027, a one-page report on the students' activities will be required.</li> <li><b>Cheating/plagiarism</b><br/>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 nought without any further consideration.</li> <li><b>After identification cheating or plagiarism, any chance will NOT be given for correction and rewrite report.</b></li> <li><b>Professional Behavior Guidelines</b><br/>During class hours, students are expected to conduct themselves in a manner that fosters a positive academic and professional atmosphere. Unauthorized discussions and unethical conduct are strictly forbidden.</li> <li><b>Ethics</b><br/>Students must NOT be late to class. All mobile phones must be turned off and put away during the class.</li> <li><b>Email</b><br/>Use your Khazar University email account <b>ONLY</b> when contacting your professor.</li> </ul> |                       |                       |

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|  | <ul style="list-style-type: none"> <li>▪ <b>Student should include “Environmental Science Project” in the subject of any emails that he/she sends, at least for the first few emails.</b></li> <li>▪ <b>Generally, all emails will be responded to within 72 hours during weekdays (not including holidays).</b></li> <li>▪ <b>Illness</b><br/>Students with an illness may miss a quiz or presentation. This might be because the student needs to go to the hospital, recover at home, or attend regular medical appointments. In this case, the student must inform the instructor in advance about the illness and must present a document from their doctor. After considering the situation, the instructor may set a new date for the quiz or project presentation. Only one opportunity will be given to the student. The students who do not inform the instructor in advance will not be given a chance to retake the quiz or give a presentation.</li> </ul> |
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#### Tentative Schedule

| Week | Date/Day (tentative) | Topics                                                                                             | Textbook/ Assignments          |
|------|----------------------|----------------------------------------------------------------------------------------------------|--------------------------------|
| 1    |                      | Introduction to Petrophysics and Well logging: terminology and application.                        | Lecture Notes / Ch.1           |
| 2    |                      | Borehole Environment, Wellsite. Quick-look log interpretation. Full interpretation.                | Lecture Notes / Ch.2           |
| 3    |                      | Lithology identification and physics of a reservoir.                                               | Lecture Notes / Ch.3           |
| 4    |                      | Spontaneous Potential (SP), Resistivity Logging (RL) and Caliper.                                  | Lecture Notes / Ch.4           |
| 5    |                      | Radioactivity logging (Total Gamma ray log, Spectral Gamma ray log, Neutron (NL, NGL) logs)        | Lecture Notes / Ch.5           |
| 6    |                      | Holiday                                                                                            |                                |
| 7    |                      | Density Log (Formation density and Litho-density logs)                                             | Lecture Notes / Ch.6           |
|      |                      | Sonic Porosity Logs (tool physics, application and limitations) and INNK. Quiz 1                   | Lecture Notes / Ch.7           |
| 8    |                      | <b>Mid-term Exam</b>                                                                               |                                |
| 9    |                      | NMR log and Residual Oil saturation.                                                               | Lecture Notes / Ch.8           |
| 10   |                      | Introduction to Rock Physics. Rock properties                                                      | Lecture Notes / Ch.9           |
| 11   |                      | Porosity and Permeability. Well Logging Data Interpretation: Additional: Geomechanics for porosity | Lecture Notes / Ch.10          |
| 12   |                      | Holiday                                                                                            |                                |
| 13   |                      | Formation resistivity and water saturation. Capillary pressure and wettability.                    | Lecture Notes / Ch.11          |
| 14   |                      | Well Logging Data Interpretation: evaluation of lithology and log correlation.                     | Lecture Notes / Ch.12          |
| 15   |                      | Hydrocarbon reserves estimation.<br>Quiz 2                                                         | Lecture Notes / Ch.13<br>Ch.14 |
|      | TBA                  | <b>Final Exam</b>                                                                                  |                                |

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