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| **Identification** | **Subject**  | PETE 415: Gas and Gas Condensate Reservoir Engineering- 4 credits |
| **Department** | Petroleum and Natural Gas Engineering |
| **Program** | Undergraduate |
| **Term** | Fall, 2016 |
| **Instructor** | Masoud Mehrizadeh |
| **E-mail:** | mmehrizadeg@khazar.org |
| **Phone:** | +994554625367 |
| **Classroom/hours** | Monday & Wednesday , 13:40-15:10 |
|  | **Office hours** |  |
| **Prerequisites** |  |
| **Language**  | English |
| **Compulsory/Elective** | Required |
| **Required textbooks and course materials** | ***Core textbooks:***Boyun Gou, Ali Ghalambor", Natural Gas Engineering Handbook" , Louisiana State University.- Ahmed, Tarek, (2005), "Advanced Reservoir Engineering", gulf Publishing Company.- Craft, B.C. & Hawkins, M. Revised by Terry, R.E. 1990 "Applied Petroleum Reservoir Engineering" *Second Edition* (Prentice Hall).***Supplementary material:*** Class Lecture Handouts and Additional Reading Materials |
| **Course outline** | The course is designed for undergraduate students. Hence, understanding of basic concepts is assumed a priori. Some similar topics will be covered but with the deep analysis in order to guide students for the future research directions. Homework assignments are crucial for the course and designed to encourage individual study. Quizzes will be provided during the classes. |
| **Course objectives**  | The main objective of this course is to bring together all fundamentals of gas reservoir engineering in coherent and systematic manner. Gas reservoir engineering is the branch of reservoir engineering that deals exclusively with reservoirs of non associated gas. The prime purpose of reservoir engineering is the formulation of development and production plan that will result in maximum recovery for a given set of economic, environmental and technical constraints. Some specifics of gas reservoir engineering functions are: * Design and interpretation of gas well production tests.
* Selection and design of appropriate recovery method.
* Prediction of Production rates and reserves.
* Evaluation of past well and reservoir performance.
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| **Learning outcomes** | **By the end of the course the students should be able:*** To know and understand the main terminology, concepts, and techniques that applies to gas reservoir engineering
* Suggest approaches and strategies for the assessment and quantification of gas reservoir uncertainty and data management
* Apply a critical-thinking and problem-solving approach towards the main principles of gas and gas condensate reservoir engineering
* Apply theoretical and practice skills in data analysis used for real problems through case studies
* Undertake, analyses, and optimize a material balance / decline curve / water influx exercise, by using a commercial software that is commonly used in the industry
* Evaluate and provide feedback on your own learning experience
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| **Teaching methods** | **Lecture**  | X |
| **Group discussion** | X |
| **Experiential exercise** |  |
| **Simulation** |  |
| **Case analysis** | X |
| **Course papers** |   |
| **Others** |  |
| **Evaluation**  | **Methods** | **Date/deadlines** | **Percentage (%)** |
| **Midterm Exam** |  | 30 |
| **Case studies** |  |  |
| **Class Participation** |  | 5 |
| **Assignment and quizzes** |  | 20 |
| **Project** |  |  |
| **Presentation/Group Discussion** |  |  |
| **Final Exam** |  | 45 |
| **Others** |  |  |
| **Total**  |  | 100 |
| **Policy** | * **Preparation for class**

The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions.* **Withdrawal (pass/fail)**

A student is normally expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. * **Cheating/plagiarism**

Cheating or other plagiarism during the Quizzes, Mid-term and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations.* **Professional behavior guidelines**

The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. |
| **Tentative Schedule** |
| **Week** | **Date/Day****(tentative)** | **Topics** | **Textbook/Assignments**  |
| 1 |  | **Introduction*** What Is Natural Gas?
* Utilization of Natural Gas
* Natural Gas Industry
* Natural Gas Reserves
* Types of Natural Gas Resources
* Future of the Natural Gas Industry
 | Handbook, Ch. 1 |
| 2 |  | **Properties of Natural Gas*** Introduction
* Specific Gravity
* Pseudocritical Properties
* Viscosity
* Compressibility Factor
* Gas Density
* Formation Volume Factor and Expansion Factor
* Compressibility of Natural Gas
* Real Gas Pseudopressure
* Real Gas Normalized Pressure
 | Handbook, Ch. 2 |
| 3 |  | **Gas Reservoir Deliverability*** Introduction
* Analytical Methods
* Empirical Methods
* Construction of Inflow Performance
 | Handbook, Ch. 3 |
| 4 |  | **Wellbore Performance*** Introduction
* Single-Phase Gas Well
* The Average Temperature and Compressibility
 | Handbook, Ch. 4 |
| 5 |  | * Factor Method
* The Cullender and Smith Method
* Mist Flow in Gas Wells
 | Handbook, Ch. 4 |
| 6 |  | **Choke Performance*** Introduction
* Sonic and Subsonic Flow
* Dry Gas Flow through Chokes
* Subsonic Flow
* Sonic Flow
* Temperature at Choke
* Applications
* Wet Gas Flow through Chokes
 | Handbook, Ch. 5 |
| 7 |  | **Well Deliverability*** Introduction
* Nodal Analysis
* Analysis with the Bottom Hole Node
* Analysis with Wellhead Node
* Production Forecast
 | Handbook, Ch. 6 |
| 8 |  | **Midterm Exam** |  |
| 9 |  | Estimation of gas reservoirs – Part 1 | Lecture Notes |
| 10 |  | Estimation of gas reservoirs – Part 2 | Lecture Notes |
| 11 |  | Estimation of gas reservoirs – Part 2 | Lecture Notes |
| 12 |  | Gas Condensate Reservoirs – Part 1 | Lecture Notes |
| 13 |  | Gas Condensate Reservoirs – Part 2 | Lecture Notes |
| 14 |  | Gas Condensate Reservoirs – Part 3 | Lecture Notes |
|  | TBA | **Final Exam** |  |

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