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| **Identification** | **Subject** | PETE 563:Petroleum Reservoir Management and Evaluation– 4 credits |
| **Department** | Petroleum Engineering |
| **Program** | Graduate |
| **Term** | Spring, 2017 |
| **Instructor** | Jabrayil Eyvazov |
| **E-mail:** | jabrayil.eyvazov88@gmail.com |
| **Phone:** | (+994 77) 531-12-31; (+99450)486-29-34 |
| **Classroom/hours** | 11 Mehseti str.(Neftchilar campus),Wednesday 18:30-21:00 |
|  | **Office hours** | Wednesday 18:30-21:00 |
| **Prerequisites** | Consent of instructor |
| **Language** | English |
| **Compulsory/Elective** | Required |
| **Required textbooks and course materials** | ***Coretextbook:***Tarek Ahmed, Nathan Meehan. Advanced Reservoir Management and Engineering, 2011L.P. Dake, Fundamentals of reservoir engineering, 2001Jitendra Kikani, Reservoir SurveillanceTarek Ahmed, Reservoir Engineering Handbook, second edition,2001 |
| **Course outline** | This course is designed for the master students. Course addressesReservoir Management: Processes, Concepts, and Analysis. Reservoir Management Application, Fundamentals of reservoir and reservoir fluidsReservoir Fluid Properties, Fundamentals of reservoir fluid flow, Hydrocarbon Recovery, Introduction to Enhanced Oil Recovery, Predicting Oil Reservoir Performance, Reservoir Monitoring Financial Analysis/ |
| **Course objectives** | *Generic Objective of the Course:*This course will cover the basic techniques used in modern reservoir management and reservoir monitoring.*Specific Objectives of the Course:*Objective of this course is to provide participants a solid understanding of various elements of integrated reservoir management strategies beginning from project start up to its successful completion. It covers reservoir management strategies of green fields as well as brown fields. As the reservoir undergoes cycles of development- early cycle to intermediate to final cycle the participants are exposed to the reservoir management principles that will lead to optimal hydrocarbon recovery. Reservoir management principles of conventional, unconventional (heavy oil, tar sands, shale gas, shale oil and tight gas) are covered. The course emphasizes surveillance strategies that are critical to achieving the objectives of improved reservoir management. Efficiencies gained from integrated reservoir management will be brought to light to the participants through various practical field examples.***Quizzes*** First quiz will be in 5th week and will be based on course materials, which had been taught by between 1-5 weeks.Second quiz will be in 13th week and will be based on course materials, which had been taught by between 7-13 weeks***Project objectives***Basic information about EOR methods and recovery factor of these methodsDetermination of which EOR is suitable for particular caseExplanation of fluid displacement processEconomic evaluation of EOR methods for particular case |
| **Learning outcomes** | Students will be able:* - To know and understand the fundamental concepts of Reservoir Management, from geology to hydrocarbons recovery
* - To learn about best techniques and practices in oil and gas fields development
* - To acquire some know-how through field case studies providing an exposure to a range of reservoir conditions
* - To get knowledge about the theory and practice of well testing and pressure analysis techniques, which is probably one of the most important subjects in reservoir engineering
* - To know about primary reservoir drive mechanisms
* - To get deeply knowledge about primary, secondary and tertiary recovery methods
* - To learn the basic principle of oil recovery mechanisms and the various forms of the material balance equation
* - To learn the fundamentals of oilfield economic analysis including risk analysis treatment of various international fiscal regimes and reserve reporting issue
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| **Teaching methods** | **Lecture** | x |
| **Group discussion** | x |
| **Experiential exercise** | x |
| **Simulation** | x |
| **Case analysis** | x |
| **Course paper** | x |
| **Others** |  |
| **Evaluation** | **Methods** | **Date/deadlines** | **Percentage (%)** |
| **Midterm Exam** |  | 30 |
| **Case studies** |  |  |
| **Class Participation** |  | 5 |
| **Assignment and quizzes** |  | 15 |
| **Project** |  | 10 |
| **Presentation/Group Discussion** |  |  |
| **Final Exam** |  | 40 |
| **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.Throughout the semester we will also have anassignment.* **Withdrawal (pass/fail)**

This course strictly follows grading policy of theSchool of Engineering and Applied Science. Thus, a student is normally expected to achieve a mark of at least 65% 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 Mid-term and Final Examinations will lead to paper cancellation.* **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 | 15.02.17 | Reservoir Management: Processes, Concepts, and Analysis* + Reservoir management process
	+ Concepts, sources of expertise, data acquisition, and data use
	+ Cycle, integration, analysis, and modeling
	+ Data Analysis, models, and Geo-Sciences Static Model
	+ Asset-Management Planning
	+ Uncertainty Management
	+ Reservoir Surveillance Plans
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| 2 | 22.02.17 | Reservoir Management Application* + Plan for a mature field and reservoir life cycle
	+ Reservoir environment and formation properties
	+ Decision Making
	+ Tools and Processes
	+ Data-Gathering Objectives and Alternatives
	+ Fundamentals of Value of Information
	+ Quick Data analysis methods
	+ Reservoir modeling
	+ Advanced decline curve analysis, material balance application, and water flooding
	+ Applying reservoir management in a newly discovered field
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| 3 | 01.03.17 | Fundamentals of reservoir and reservoir fluids* Classification of reservoirs and reservoir fluids
* Pressure-temperature diagram
* Oil reservoirs
* Gas reservoirs
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| 4 | 08.03.17 | Holiday |  |
| 5 | 15.03.17 | RESERVOIR-FLUID PROPERTIES* Properties of crude oil systems
* Crude oil gravity
* Specific gravity of the solution gas
* Gas solubility
* Bubble-point pressure
* Oil formation volume factor
* Isothermal compressibility coefficient of crude oil
* Oil formation volume factor for undersaturated oils
* Crude oil density
* Crude oil viscosity
* Methods of calculating viscosity of the
* dead oil
* Methods of calculating the saturated oil
* viscosity
* Methods of calculating the viscosity of
* the undersaturated oil
* Surface/interfacial tension
* Properties of reservoir water
* Water formation volume factor
* Water viscosity
* Gas solubility in water
* Water isothermal compressibility

*Quiz 1* |  |
| 6 | 22.03.17 | Holiday |  |
| 7 | 29.03.17 | RESERVOIR-FLUID PROPERTIES* Properties of natural gases
* Behavior of ideal gases
* Behavior of real gases
* Effect of non-hydrocarbon components of the Z-factor
* Non-hydrocarbon adjustment methods
* The Wichert-Aziz correction method
* Correction for high-molecular weight gases
* Direct calculation of compressibility factors
* Compressibility of natural gases
* Gas formation volume factor
* Gas viscosity
* Methods of calculating the viscosity of natural gases
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| 8 | 05.04.17 | FUNDAMENTALS OF RESERVOIR FLUID FLOW* Types of fluid
* Flow regimes
* Resevoir geometry
* Number of flowing fluids in the resevoir
* Fluid flow equations
* Darcy’s Law
* Steady-state flow
* Linear flow of incompressible fluids
* Linear flow of slightly compressible fluids
* Linear flow of compressible fluids (gases)
* Radial flow of incompressible fluids
* Radial flow of slightly compressible fluids
* Radial flow of compressible gases
* Horizontal multiple-phase flow
* Unsteady-state flow
* Basic transient flow equation
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| 9 | 12.04.17 | Midterm exam |  |
| 10 | 19.04.17 | FUNDAMENTALS OF RESERVOIR FLUID FLOW* Constant-terminal-pressure solution
* Constant-terminal-rate solution
* The E-function solution
* The dimensionless pressure drop (Pd)solution
* Radial flow of compressible fluids
* The m(p)-solution method(exact-solution)
* The pressure-squared approximationmethod (p2-method)
* The pressure-approximation method
* Pseudosteady-state flow
* Radial flow of slightly compressible fluids
* Radial flow of compressible fluids(gases)
* Pressure-squared approximation method
* Pressure-approximation method
* Skin factor
* Turbulent flow factor
* Principle of superposition
* Effects of multiple wells
* Effects of variable flow rates
* Effects of the reservoir boundary
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| 11 | 26.04.17 | Hydrocarbon Recovery* Primary Recovery
* Primary Drive Mechanisms
* Rock and Liquid Expansion
* Depletion Drive Mechanism
* Solution Gas Drive Mechanism
* Gas Cap Drive Mechanism
* Water Drive Mechanism
* Gravity Drainage Mechanism
* Combination Drive Mechanism
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| 12 | 03.05.17 | Introduction to Enhanced Oil Recovery* Mechanisms of Enhanced Oil Recovery
* Enhanced Oil Recovery Methods
* Thermal Processes
* Cyclic Steam Stimulation
* Steam Hooding {Steam Drive)
* Steam-Assisted Gravity Drainage
* In Situ Combustion
* Chemical Flood
* Polymer Flood
* Surfactant Slug and Micellar Solution Flood
* Miscible Gas Flood
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| 13 | 10.05.17 | Predicting Oil Reservoir Performance* Reservoir Performance
* Prediction Methods
* Instantaneous GOR
* The Reservoir Saturation
* Equations an d their Adjustments
* Under-saturated Oil Reservoirs
* Saturated Oil Reservoirs
* Oil Well Performance
* Vertical Oil Well Performance
* Horizontal Oil Well Performance
* Horizontal Well Productivity under Steady-State Flow

*Quiz 2* |  |
| 14 | 17.05.17 |  Reservoir Monitoring* + Reservoir Surveillance
	+ Pressure profiling
	+ Production logging, measurements, and interpretation
	+ Saturation monitoring
	+ Water control
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| 15 | 24.05.17 | Financial Analysis* Fixed Capital Investments
* Cost Basis
* Cash Flow Consequences
* Maintenance Expense
* Additions of Fixed Capital
* Working Capital
* Financial Reporting
* Generally Accepted Accounting Principles (GAAP)
* Net Income
* Timing Differences
* Depreciation, Depletion, and Amortization (DD&A)
* Deferred Tax
* Cash Flow Generation
* Discounted Payout
* Discounted Cash Flow Return on Investment
* Net Present Value and
* Discounted Cash Flow Return on Investment
* Rate Acceleration Investments
* Present Value Ratio (PVR)
* Growth Rate -of-Return (GRR )
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|  | TBA | **Final Exam** |  |

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