

KHAZAR UNIVERSITY

DEPARTMENT OF PETROLEUM ENGINEERING

**COURSE SYLLABUS**

**ADVANCED PETROLEUM RESERVOIR ENGINEERING**

## Khazar University

### Department of Petroleum Engineering

This syllabus was completed to fit established academic framework of the School of Engineering and Applied Science of Khazar University. As this is the document that will guide you throughout the course, please read it very carefully. You will have been given a copy of this Syllabus.

#### Identification

Subject:	Advanced Petroleum Reservoir Engineering (PETE 512)
Department:	Petroleum Engineering
Instructor:	assoc. prof. Gurbanov Rafiq S.
Office:	# 416
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Term:	Spring 2010

#### Prerequisites:

Petroleum Reservoir Engineering (PETE 313)

#### Textbooks and

#### Materials:

##### **Core material:**

1. Adrian Todd, Jim Somerville. Petroleum Reservoir Engineering  
Edinburgh.. 2004. .

##### Supplementary::

2. B.C. Craft, M.F. Hawkins. Applied Petroleum Reservoir Engineering.  
Prentice Hall Englewood Cliffs.
3. Reservoir Engineering Handbook, 2006.

For class presentations and discussion, the students should utilize Journal, and Internet materials, the course doesn't limit the use of learning materials available at Khazar University library.

Course description: Reservoir engineering may be defined as the application of scientific principles to the drainage problems arising during the development and production of oil and gas reservoirs. It has also been defined as "the art of developing and producing oil and gas fluids in such a manner as to obtain a high economic recovery." Because reservoir engineering is the science of producing oil and gas, it includes a study of all the factors affecting their recovery. Ultimately reservoir engineering concerns all petroleum engineers, from the drilling engineer who is planning the mud program to the corrosion engineer who must design the tubing string for the producing life of the well (B.C.Craft and M.F. Hawkins).

Objective:

This course is designed for the petroleum engineer and other petroleum students. The purpose of the present discipline training is the perfection and deepening of the theoretical and practical knowledge of the future petroleum specialists.

Generic Objective of the course:

To provide of modern concepts of illumination on Petroleum reservoir. Analysis of oil field data using all Petroleum tools. Reservoir description, calculation of hydrocarbon reserves, properties of reservoir fluids, properties of reservoir rocks, formation drive mechanisms, the displacement of oil and gas, recovery efficiency, material balance equation water influx and so on.

Specific Objectives of the course:

- To support the students academically, to improve their chance of realizing their potential.
- To encourage students participation and in interaction and fostering and atmosphere of tolerance and respect.
- To develop on understanding of the theory and practice in Petroleum Reservoir Engineering.
- To build background for the student's further Petroleum Engineering Development.

Outline:

The field of Engineering is closely related to Petroleum Industry specialists.

Outcome:

By the end of the course the students should be able:

- To get knowledge in theory and practice of Petroleum Reservoir Engineering
- To solve out problems by on Petroleum Reservoir Engineering

Developed Skills

Throughout the course the students should develop and maintain the following skills:

- Analytical thinking
- Critical reasoning
- Manifestation of engineering skills
- Leadership
- Presentation
- Other

**Evaluation**

Quizzes	10%
Course Project	10%
Participation & activity	10%
Mid-Term Exam	30%
<u>Final Exam</u>	<u>40%</u>
<b>Total</b>	<b>100%</b>

Learning & Teaching  
Methods

This course considers active learning process rather than passive, one-studying lectures, discussions, simulating, case analysis.

WEEKLY SCHEDULE

Weeks	Topics	Hours		References
		Lectures	Practicals	
1	2	3	4	5
1	Introduction to Reservoir Engineering. History of reservoir engineering. The coordinating role of reservoir engineer in reservoir development. Hydrocarbon reserves estimation. Development planning. Petroleum reserves calculation.	3	1	[1] Ch 1 p.1-16
2	Reservoir pressure and temperature. Abnormal pressure. Abnormally pressured reservoirs. Pressure gradients around the WOC. Reservoir temperature. Solutions to Exercises.	3	1	Ch 1 p.3-13 [2] Ch 3 p. 97-99
3	Reservoir fluids composition. Chemistry of hydrocarbons. Non-hydrocarbon compounds. Compositional description for reservoir engineering. Solutions to exercises.	3	1	[1] Ch 3 p.1-16
4	Phase behavior of hydrocarbon systems. Phase behavior of pure substances. Two component systems. Retrograde condensation. Multi-component hydrocarbon.	4		[1] Ch 4 p.1-25
5	Behavior of gases. Ideal gas laws. The equation of state for an ideal gas. Dalton's law of partial pressures. Amagat's law. Molecular weight and specific gravity of gas. Behavior of real gases. Compressibility factor. Law of corresponding states. Solutions to exercises. Homework.	3	1	[1] Ch 5 p.1-35
6	Properties of reservoir liquids. Composition of black oil models. Volume factors. Bubble point. Oil compressibility. Fluid density, viscosity, interfacial tension. Comparison of fluid models. Solutions to exercises.	3	1	[1] Ch 6 p 1-47
7	Physical characteristics of reservoir rocks. Porosity. Permeability. Darcy's law. Stress effects on core measurements. Porosity-permeability relationships. Surface kinetics. Effective			[1] Ch 7 p.1-49 [1] Ch 8 p.1-40

	permeability. Rock properties measurement. Capillary pressure. Average permeability for several layers.	4		[1] Ch 9 p.1-16
8	Midterm Exam			
9	Fluid flow in porous media. Characterisation of flow patterns. The steady state solution. Non-steady state solution. The skin factor. Principle of superposition.	4		[1] Ch 10 p.1-131
10	Drive mechanisms. Natural drive mechanisms types. Reservoir performance of different drive systems. Oil recovery factor in different drive mechanisms. Well spacing in different drive mechanisms.	4		[1] Ch 11 p.1-21
11	Material balance equation (MBE). Material balance for gas reservoirs. The general material balance equation. Solutions to exercises.	3	1	[1] Ch 15 p1-29
12	Material balance equation application Linear form of material balance equation. Gas field applications of MBE. Material balance equation applied to oil reservoirs. Solution to exercise. Calculation of initial oil and gas. Homework.	3	1	[1] C16 p.1-35 [2] Ch 4 p. 110-118
13	Water influx. Models for water encroachment. Reservoir performance prediction. History matching water influx. Solution to exercise.	3	1	[1] Ch 17 p.1-48
14	Immiscible displacement. The reason for water injection. Basic water drives theory.	2	2	[1] C 18 p.1-35
15	Displacement theories. Immiscible displacement processes. Recovery efficiency.	2	2	[1] C 18 p.56-76 [2] Ch 9
16	Course Project Presentation.		4	
17	Final Exam			