KOMAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(KUST)

RESERVOIR ROCK PROPTERTIES AND LAB			
Course Title	**Reservoir Rock Properties and Lab**		
Course Code	**PTE 3310C**	**No. of Credits**	**3 CR (2 Theor, 1 Prac)**
Department	**Petroleum Department**	**College**	**College of Engineering**
Pre-requisites Course Code	**GEO 2315, MEE2405**	**Co-requisites Course Code**	**N/A**
Course Coordinator(s)	**Hiwa Sidiq**		
Email	**hiwa.sidiq@komar.edu.iq**	**IP No.**	
Other Course Teacher(s)/Tutor(s)	**None**		
Class Hours	**SUN//THU: 14:00-15:30 Room: 203**		
Contact Hours	**SUN: 13:00 - 16:00 Room: 308**		
Course Type	**Departmental Requirement**		
Offer in Academic Year	**Fall 2015**		

COURSE DESCRIPTION

This course provides an introduction into rocks and pore-filling fluids, rock properties of the reservoir, particularly how pores are interconnected and controlling the accumulation and migration of hydrocarbons. The routine and special core analysis methods including porosity, permeability, and relative permeability measurements as well as measurements of electrical/acoustic properties of reservoir rock will be provided in details.

COURSE OBJECTIVES

The objectives of this course are for students to become familiar with reservoir rocks petrophysical characteristics and the methods of measurements.

COURSE LEARNING OUTCOMES

After participating in the course, students should be able to:

1. Prepare the samples for the routine core analysis studies. (ABET B)
2. Know the types of pore spaces and its effect on permeability and fluid saturation. (ABET A)
3. Measure porosity, permeability and the factors affecting the measurements and present results. (ABET B and D)
4. List and analyse the factors controlling the permeability values at micro and macro scale. (ABET A and K)
5. Understand the porosity-permeability relationships. (ABET E)
6. How to measure resistivity of rock samples and know the effective factors controlling the measurements. (ABET B)
7. Perform reservoir rock characterization. (ABET A and B)
8. Know and calculate thermal properties of rocks. (ABET K and B)

***Some of the course outcomes are subjected to the availability of Coreflooding rig and lab.**

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RELATED PROGRAM OUTCOMES:	
A	An ability to apply knowledge of mathematics, science, and engineering
B	An ability to design and conduct experiments, as well as to analyze and interpret data
D	An ability to function on multidisciplinary teams
E	An ability to identify, formulate, and solve engineering problems
J	A knowledge of contemporary issues
K	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Reference:http://www.abet.org/eac-criteria-2014-2015/

GUIDELINES ON GRADING POLICY

Points		*Percentage Scores*	*Grade*
A *A-*		*95–100* *90-94*	*4.0* *3.7*
B+ *B* *B-*		*87–89* *83-86* *80-82*	*3.3* *3.0* *2.7*
C+ *C* *C-*		*75–79* *70-74* *65-69*	*2.3* *2.0* *1.7*
D+ *D* *D-*		*60–64* *55-59* *50-54*	*1.3* *1.0* *0.7*
F		*0–49*	*0*
I	*Incomplete Course Work*		
W	*Official Withdrawal*		

Passing Grade is 65% or above

COURSE CONTENTS

Course topics include:

- Introduction to Petroleum Geology
- Porosity and Permeability
- Formation Resistivity and Water Saturation
- Capillary Pressure and Wettability
- Naturally Fractured Reservoir
- Reservoir GeoMechanics
- Reservoir Characterisations
- Fluid Rock Interactions
- Basic Log interpretations

Note: Adding more chapters is governed by the time.

Course Teaching and Learning Activities:

Lectures: during week, the theoretical and practical lectures will be presented throughout the semester; the discussion of practical work within lab will be organized and illustrated with activities.

Assignments: after the lectures, the assignment will be explained and given to students. It is expected to be done on weekly bases.

Quizzes: the contents of each lecture will be discussed during class for open question and answer to make sure every student will participate and active.

Practical Discussion: during practical session the students will combine together as partners and form a group to discuss their class learning and open tutorial on the topics.

In class brainstorming sessions: provide students with enough sources and background knowledge briefly within the topics during class to top up their challenge packs to be more active.

CLASS REQUIREMENT

- A Scientific Calculator
- Notebook

***Note: Students must bring a notebook, a pen, notebook, calculator, and the periodic table to every class**

Assessment Tool	Description	Weight
Lab experiments and reports	Reports on lab activity and tests (ABET A, G and D)	20%
Quizzes	The open question and answer during class (ABET A and E)	10%
Assignments	Fortnightly assignments within the updated topics and Presentation (ABET G and D)	20%
Mid-term exam	Paper examination – all topics that were studied are included (ABET A and K)	20%
Final Exam	Examination questions-all topics that were studied during the semester are included (ABET A, E and K)	30%

ESSENTIAL READINGS: (Journals, textbooks, website addresses etc.)

Textbooks:

Petrophysics: Theory and Practice of Measuring Reservoir Rock and Fluid Transport Properties. Djebbar Tiab, Erle C. Donaldson, 3rd Edition 2012. ISBN 0123838487, 9780123838483

References:

- Applied geostatistics for Reservoir Characterisation, Mohan Kelkar et al, 2002, ISBN:978-1-55563-095-9
- Hydrocarbon reservoir characterization: geologic framework and flow unit modeling, Emily L. Stoudt, Paul Mitchell Harris, 1995.

- Carbonate Reservoir Characterization: An Integrated Approach, F Jerry Luccia, 2007, ISBN 978-3-540-72740-8.
- Proceedings: 1996 International Symposium of the Society of Core Analysts : Improving reservoir management

COURSE POLICY *(including plagiarism, academic honesty, attendance etc)*

KUST Academic Policy

http://sar.komar.edu.iq/files/Student%20hand%20Book%202013.pdf

Attendance:

- Students are expected to attend all lectures and must attend all examinations, quizzes, and practical exercises.
- There is no make-up work for students who miss classes without official permission.
- Student must arrange with the faculty to make-up the missed class.
- Students are subject to the regulation and policies mentioned in the KUST Student Handbook.
- KUST guidelines for lateness are as follows: Three occasions of lateness count as one absence. (You can be considered late the first minute of the lecture time).

GUIDELINES FOR SUCCESS

1. Be able to work independently and in groups,
2. Pay-attention in the classes is the guarantee of success,
3. Extend your knowledge beyond the given textbooks in order to master the subject, and
4. Try not to miss the classes

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Course calendar: Please check the academic calendar for 2015/2016

Week	Beg/End Dates	Topics	Assessment
1	28 Sep – 1 Oct	- Introduction to Petroleum Geology Sedimentary Basins Origin of Petroleum Environmental Deposition Hydrocarbon trap types	
2	4– 8 Oct	- Reservoir Rock Properties Hydrostatic/Lithostatic pressure gradient Reservoir Rock Compressibility Types and Classifications of Porosity What is Permeability	
3	11– 15 Oct	- Lab-1; Petrographic Image Analysis: Thin-Section Preparations, Internal Surface Area Per unit of pore volume Spv Specific Surface Area of a Porous Material Svgr, K measurements	Practical
4	18– 22 Oct	- Permeability Classification Factors Affecting Permeability K-Poro Relashinship - Kozeny correlation Concept of Flow Unit Reservoir Quality Index	Quiz 1
5	25– 29 Oct	- Flow Unit Function Reservoir Zonation - K From Log K-Poro in Carbonate Rocks K Estimation in Carbonate Rocks	Assignment 1
6	1– 5 Nov	- Lab-2: Routine core analysis: - Sample Preparation - Brine preparation - Absolute Porosity and Permeability measurements	Practical
7	8– 12 Nov	- Directional Permeability Kh/kv Relationship - Rock Properties Distribution Averaging Techniques Reservoir Heterogeneity Effective K from Core Data	Quiz 2
15– 19 Nov Midterm Exam			
8	22– 26 Nov	- Formation Resistivity Methods for Determining Saturation Factors Affecting Resistivity	Assignment 2

		- Formation Water Resistivity SP curves Resistivity Factor-Shale Rocks	
9	29– 3 Dec	- Lab-3: Throughput tests: Measuring Effective Permeability for Brine and Oil - Kw@Sor, - Ko@Swr	Practical
10	6– 10 Dec	- F_R and Cementation F_R and Water Saturation F_R and Permeability F_R and Shale, Flow Unit Shaly Sandstone Basic of Well Log Interpretation	Quiz 3
11	13– 17 Dec	- Capillary Pressure and Measurements Capillary and J Function Pore Size Distribution Capillary Number - Wettability Wettability Index and Measurements	Assignment 3
12	20– 24 Dec	- Lab-4; Getting started with simulation: - How to prepare a reservoir model From a Scratch	Practical
27– 31 Dec New Year Holiday			
13	3– 7 Jan	- Naturally Fractured Reservoir Geological and Engineering Classification of NFR Fluid Flow in NFR - GeoMechanic of Reservoir Rocks Young's, Shear, and Bulk modulus Stress-strain Relationship	Quiz 4
14	10– 14 Jan	- Reservoir Characterisations Reservoir Volume Isopach Map Hydraulic Units Fluid Rock Interaction	Quiz 5
15	17– 21 Jan	Review Week	
24 -28 Jan Final Exam			

*The above timetable may be changed depending on lab availability.