KOMAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(KUST)

RESERVOIR FLUID PROPERTIES SYLLABUS			
Course Title	**Reservoir Fluid Properties and Lab**		
Course Code	**PTE 3315C**	**No. of Credits**	**3 CR (2 Theor, 1 Prac)**
Department	**Departments of Engineering**	**College**	**College of Engineering**
Pre-requisites Course Code	**MEE 3310**	**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)	**Non**		
Class Hours	**MON//WED: 10:00 – 11:30 Room: 103**		
Contact Hours	**SUN: 13:00 - 16:00**		
Course Type	**Departmental Requirement**		
Offer in Academic Year	**Spring 2016**		

COURSE DESCRIPTION

This course describe naturally occurring hydrocarbon systems found in the reservoirs as the mixtures of organic compounds that exhibits multiphase over wide ranges of pressures and temperatures. The effect of phase behavior during the life time of the reservoir on production and recovery will be explained in detail. The key oil properties, such as bubble point, GOR, FVF, viscosity etc, will be studied and how these properties are calculated.

COURSE OBJECTIVES

The objective of this course is to help student to be familiar with reservoir fluid properties and how PVT and laboratory data are used for tuning EOS and predictive models. Moreover, PVT envelope analysis and experimental work design.

COURSE LEARNING OUTCOMES

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

1. Calculate and measure fluid properties such as density, viscosity etc. (ABET B, D and K)
2. Apply thermodynamic aspects to understand reservoir fluids behavior. (ABET A and E)
3. Construct phase diagrams for different reservoir fluid type (ABET A and E)
4. Calculate fluid properties such as density, specific gravity, compressibility etcl using EOS. (ABET A, and E)
5. Apply different EOS methods to calculate fluid properties and compare the results (ABET A, B and E)
6. Design PVT tests for reservoir fluids. (ABET A and E)
7. Apply the five reservoir fluids concept in production and surface facility design. (ABET A and B)
8. Generate the required PVT input data for reservoir simulation using industry standard software. (ABET B, D and K)

***Some of the course outcomes are subjected to PVT lab availability.**

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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
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	*95–100*	*4.0*
A-	*90-94*	*3.7*
B+	*87–89*	*3.3*
B	*83-86*	*3.0*
B-	*80-82*	*2.7*
C+	*75–79*	*2.3*
C	*70-74*	*2.0*
C-	*65-69*	*1.7*
D+	*60–64*	*1.3*
D	*55-59*	*1.0*
D-	*50-54*	*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 Reservoir Fluids
- Compositional Analyses
- PVT Experiments
- Equations of State
- Plus fraction characterisation
- Flash and Phase Envelope Calculations
- PVT Simulation
- Regression to Experimental PVT Data
- Compositional Variations with Depth

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 be 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 activities and tests (ABET B, D and K)	20 %
Quizzes	The open question and answer during class (ABET A and E)	10 %
Assignments	Assignments within the updated topics and presentation (ABET D and J)	10 %
Tests	Two tests before and after the midterms (ABET A and E)	10 %
Mid-term exam	Paper examination – all topics that were studied are included (ABET A and E)	20 %
Final Exam	Examination questions-all topics that were studied during the semester are included (ABET A, and E)	30 %

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

Textbooks:

The Properties of Petroleum Fluids McCain, W. D., Penn Well Publishing Co., Tulsa, 2nd Edition, 1990. ISBN 878143351

References:

- PVT and Phase Behaviour of Petroleum Reservoir Fluids, Ali Danesh, 3rd Edition 2003. ISBN 0444821961
- Equations of State and PVT Analysis, Tarek Ahmad 2013. ISBN 0127999787

- Phase behavior, Curtis H. Whitson, Michael R. Brulé 2000. ISBN 1555630871
- The Properties of Gas and Liquids, Bruce E. Poling et al, 2001. ISBN 0070116822

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 Feb – 3 Mar	- An Introduction into Reservoir Fluid - Alkanes, Alkenes, and Alkynes - Phase Behavior	
2	6– 10 Mar	- Phase Behavior of Pure substance - Phase behavior two components - Phase behavior of three and multicomponents	Quiz 1 (W1-W2)
3	13– 17 Mar	- Types of phase diagram - Ternary diagram - Use of ternary diagram - Reservoir fluid types - Reservoir fluid classifications	Assignment 1 (19th Mar)
20-24 March Nowroz Holiday			
4	27– 31 Mar	- Lab-1: Fluid density measurement: - Sample Preparation - Density measurement of oil and water	Practical
5	3– 7 Apr	- Equation of State - Ideal gas law - Density of ideal gas - Kinetic theory of gas - Mixture of Ideal gases-partial pressure laws	Test 1 (7th Apr) (W1-W3&W5)
6	10– 14 Apr	- Specific gas gravity - Real gas behavior - Real gas behavior - Pseudocritical properties	Quiz 2 (W5-W6)
7	17– 21 Apr	- Lab-2: Viscosity measurement: - Viscosity measurement of water and oil, - Viscosity measurement using falling ball viscometer.	Practical
22-28 April Midterm Exam			
8	1– 5 May	- Other EOS for real gas - EOS at critical point - Virial EOS - RK and Peng-Robinson EOS - Mixing Ruls - The Five Reservoir Fluids - Gas FVF	Assignment 2 (3rd May)
9	8– 12 May	- Coefficient of gas compressibility - Cg for ideal gas and real gas - The coefficient of gas viscosity - Properties of Black Oil - Formation volume factor	Quiz 3 (W8)

		- Oil GOR - Total FVF - Oil viscosity and interfacial tension	
10	15– 19 May	- Reservoir fluids sample collection - Laboratory tests 1. Compositional measurements 2. CCE 3. DL 4. Separator test	Assignment 3 (21th May)
11	22– 26 May	Lab-3; Methods of interfacial tension measurements: • Capillary rise method • Wilhelmy plate method • Ring method • Drop weight method • Pendant drop method ➢ Interfacial tension (IFT) measurement using pendant drop method	Practical Quiz 4 (W9)
12	29 May– 2 Jun	- Properties of BO- correlations - Solution Gas-Oil Ratio - Oil density - Bubble point - Gas Liquid Equilibria - Vapor-liquid-Equilibrium VLE - Bubble point	Test 2 (31st May) (W8-W10)
13	5 – 9 Jun	Lab-4; Getting started with PVTP simulation Pure, two and multi component investigation ➢ CCE, DL and flash tests ➢ Oil viscosity and density calculation	Practical
14	12– 16 Jun	- Gas Liquid Equilibria - Non ideal fluid - Differential vaporization - Surface separation	Quiz 5 (W12)
15	19 – 23 Jun	Review Week	
26 -30 Jun Final Exam (W1-W15)			

*The above timetable may change and depends on lab availability.