MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Petrophysical Rock Properties**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** **Lecture** ☒ **Lab** ☒ **Tutorial** **Practical** **Seminar**	
Module Code	**PE 222**				
ECTS Credits	**7**				
SWL (hr/sem)	**175**				
Module Level	2		**Semester of Delivery**	4 th	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	• PE215	**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	The objectives of this course are for students to become familiar with reservoir rocks' petrophysical characteristics and the methods of measurement. Petrophysical Rock Properties is an introductory module focusing on the fundamental concepts and principles of reservoir engineering in the oil and gas industry. The module provides students with: 1. A solid foundation in understanding reservoir characteristics, behavior, and management. 2. Provides students with the necessary knowledge and skills to analyze reservoir behavior, predict performance, and make informed reservoir development and management decisions. 3. It is a foundation for more advanced reservoir engineering modules and prepares students for practical oil and gas industry applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The student should be able to: • Define porosity, discuss the factors that affect porosity, and describe the methods of determining porosity values. • Define the compressibility of reservoir rock and describe methods for determining values of formation compressibility. • Reproduce the Darcy equation in differential form, explain its meaning, and integrate it for a typical reservoir system. • Discuss and calculate the effect of fractures and channels and describe methods for determining values of absolute permeability. • Explain surface tension and wettability and their effect on capillary pressure, describe methods of determining capillary pressure values, and convert laboratory capillary pressure values to reservoir conditions. • Describe the method of determining fluid saturations in reservoir rock and show the relationship between fluid saturation and capillary pressure. • Define effective permeability, relative permeability; reproduce typical relative permeability curves and • Show the effect of saturation history on relative permeability; illustrate the measurement of relative permeability; and demonstrate some uses of relative permeability data. • Describe two-phase flow in reservoir rock and explain methods of displaying tow-phase effective permeabilities. • Demonstrate the techniques of averaging porosity, permeability, and reservoir data. • Demonstrate capability to perform calculations relating to all concepts above.
Indicative Contents المحتويات الإرشادية	**Lecture titles** • Introduction to Petrophysics and Core Analysis • Porosity, Rock Compressibility, • Permeability, Permeability-Porosity Relationships, • Capillary Tube Models of Porous Media, Carman-Kozeny Equation, Tortuosity, Poiseuille's Law, • Darcy's law; measurements of permeability, • Fundamentals of Reservoir Fluid Flow, Types of fluids in the reservoir, Flow Regimes, • Reservoir Geometry, Linear Flow, Horizontal Flow, Vertical Flow, • Radial Flow, Spherical and Hemispherical Flow, • Flow in Layered Systems, Averaging Techniques, • Flow in Channels and Fractures, • Gas flow, The Klinkenberg Effect, • Reservoir Heterogeneity, • Fluid Saturation, Wettability, Surface and Interfacial Tension, • Capillary Pressure, Capillary Hysteresis, Leverett J-Function,

	• Effective and relative permeability, • Estimation of Hydrocarbons in Place, Net to Gross. • Two Phase Flow Through Porous Media; Linear Flow (Piston Like, Leaky Piston) • Fractional Flow Equation; Buckley Leverett Equation

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

Lectures: during the week, the theoretical and practical lectures will be presented throughout the semester; the discussion of practical work within the 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 a weekly basis.
Quizzes: the contents of each lecture will be discussed during class for open questions and answers to make sure every student will participate and be active.
Practical Discussion: during the practical session, the students will combine as partners and form a group to discuss their class learning and open tutorials 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

Methods of assessment for students.

Assessment Tool	Description	Weigh
Lab experiments and reports	Reports on lab activity and tests	20%
Quizzes	The open question and answer during class	10%
Assignments	Fortnightly assignments within the updated topics and Presentation	10%
Mid-term exam	Paper examination – all topics that were studied are included	10%
Final Exam	Examination questions-all topics that were studied during the semester are included	50%

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**175**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	None	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Petrophysics and Core Analysis Porosity, Rock Compressibility
Week 2	Permeability, Permeability-Porosity Relationships
Week 3	Capillary Tube Models of Porous Media, Carman-Kozeny Equation, Tortuosity, Poiseuille's Law
Week 4	Darcy's law; measurements of permeability, Fundamentals of Reservoir Fluid Flow, Types of fluids in the reservoir, Flow Regimes
Week 5	Reservoir Geometry, Linear Flow, Horizontal Flow, Vertical Flow, Radial Flow, Spherical and Hemispherical Flow
Week 6	Flow in Layered Systems, Averaging Techniques
Week 7	Flow in Channels and Fractures
Week 8	Gas flow, The Klinkenberg Effect
Week 9	Reservoir Heterogeneity
Week 10	Fluid Saturation, Wettability, Surface and Interfacial Tension

Week 11	Capillary Pressure, Capillary Hysteresis, Leverett J-Function
Week 12	Effective and relative permeability
Week 13	Estimation of Hydrocarbons in Place, Net to Gross
Week 14	Two Phase Flow Through Porous Media; Linear Flow (Piston Like, Leaky Piston)
Week 15	Fractional Flow Equation; Buckley Leverett Equation

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Core cutting and preparation
Week 2	Core cleaning and drying
Week 3	Rock bulk volume determination by using caliper
Week 4,5	Rock bulk volume determination by using mercury pump porosimeter
Week 6	Rock bulk volume determination by using electric pycnometer
Week 7,8	Rock pore volume determination by saturation method
Week 9, 10	Rock pore volume determination by mercury injection method
Week 11	Rock grain volume determination by air injection method (kobe method)
Week 12	Rock grain volume determination by crushing method
Week 13	Absolute permeability determination by using liquid permeameter
Week 14	Absolute permeability determination by using gas permeameter
Week 15	Residual fluid saturation determination by retort method

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Text and Books	• Curriculum and Textbook	Yes

Recommended Texts	• Amyx, Petroleum Reservoir Engineering Physical Properties, 1960 • Tarek Ahmed, Reservoir Engineering handbook, fifth Edition,2019	
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.