

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Petrophysical - Properties		Module Delivery
Module Type	Core	☒ Theory Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	PE222		
ECTS Credits	7		
SWL (hr/sem)	175		
Module Level	2	Semester of Delivery	4 th
Administering Department	Petroleum Engineering	College	College of Engineering
Module Leader	Dr .Tuqa Abdulrazzaq	e-mail	Tuka-2023@coeng.uobaghdad.edu.iq
Module Leader's Acad. Title	Asst.prof	Module Leader's Qualification	Ph.D.
Module Tutor	Dr .Tuqa Abdulrazzaq	e-mail	tuqa.abdulrazzaq@alayen.edu.iq
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الاخرى			
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	By the end of this module, students will be able to: 1. Develop analytical and problem-solving skills through the application of petroleum engineering techniques. 2. Gain foundational knowledge of petrophysical properties and measurement techniques, including bulk volume, grain volume, pore volume, and porosity. 3. Explore key reservoir properties such as permeability, capillary pressure, and wettability. 4. Perform and interpret subsurface logging techniques, including SP-log and gamma ray analysis. 5. Recognize the contribution of geophysics to geological interpretation through the study of Earth's physical properties. 6. the methods of measurement. Petrophysical Rock Properties is an introductory module focusing on the fundamental 7. The module provides students with: 8. A solid foundation in understanding reservoir characteristics, behavior, and management. 9. Provides students with the necessary knowledge and skills to analyze reservoir behavior, predict 10. performance, and make informed reservoir development and management decisions. 11. It is a foundation for more advanced reservoir engineering modules and prepares students for practical oil 12. and gas industry applications.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Knowledge	A2	A2.1 Define and understand the basic principles of petrophysical (porosity, Permeability, compressibility, capillary pressure) A2.2 classify and describe petrophysical properties one by one Apply mathematical calculation by using data obtained by measurements A2.3 compare among the different petrophysical properties
		A3	A3.1. identify core (rock sample) learn how to prepare it for experiments A3.2. classify the type of cores and start to do the experiments (volume of bulk volume of grain, porosity, saturation) ...etc A3.3. Analysis data of the experiment (procedure, Collect results and analyze data
	skills	B1	B1.1 Function efficiently as an individual B1.2 Function as a member of multidisciplinary and multicultural Teams
		B2	B2.1 Communicate effectively – graphically with a range of audiences using contemporary tools. B2.2 Communicate verbally and in writing with a range of audiences using contemporary tools.

	Ethics	C2	C.2.1 Plan engineering projects, taking into consideration other trades requirements. C.2.2 Supervise and monitor engineering projects, taking into consideration other trades requirements.
	Indicative Contents المحتويات الإرشادية 1. Introduction to Petrophysics and Core Analysis 2. Porosity, Rock Compressibility, 3. Permeability, Permeability-Porosity Relationships, 4. Capillary Tube Models of Porous Media, Carman-Kozeny Equation, Tortuosity, Poiseuille's Law, 5. Darcy's law; measurements of permeability, 6. Fundamentals of Reservoir Fluid Flow, Types of fluids in the reservoir, Flow Regimes, 7. Reservoir Geometry, Linear Flow, Horizontal Flow, Vertical Flow, 8. Radial Flow, Spherical and Hemispherical Flow, 9. Flow in Layered Systems, Averaging Techniques, 10. Flow in Channels and Fractures, 11. Gas flow, The Klinkenberg Effect, 12. Reservoir Heterogeneity, 13. Fluid Saturation, Wettability, Surface and Interfacial Tension, 14. Capillary Pressure, Capillary Hysteresis, Leverett J-Function, 15. Effective and relative permeability, 16. Estimation of Hydrocarbons in Place, Net to Gross. 17. Two Phase Flow Through Porous Media; Linear Flow (Piston Like, Leaky Piston) 18. Fractional Flow Equation; Buckley Leverett Equation		
	This module provides essential foundational knowledge for students pursuing careers in subsurface resource exploration and development. It emphasizes the integration of scientific reasoning, data interpretation, and societal context in petroleum engineering practice. Students will: • Apply the scientific method to investigate subsurface phenomena and draw conclusions based on empirical, verifiable evidence. • Analyze the impact of scientific theories, technological advancements, and engineering discoveries on petroleum exploration and their broader implications for society. • Demonstrate critical thinking and analytical skills in evaluating geological and petrophysical data, including the ability to question assumptions and assess data reliability. • Recognize that real-world data often contain uncertainties and develop strategies to interpret such data using sound judgment, domain knowledge, and contextual understanding.		

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

Teaching/Learning Strategies include:

- 1- Direct Instruction in classroom, 2 hrs per week.
 - 2- Classroom Discussions
 - 3- tests, quizzes, class participation, projects, homework assignments, presentations.
 4. lab and experimental
- Methods of assessment for students.
- 1- Compulsory exercises
 - 2- Quarterly exams.
 - 3- Discussions and assignments for project.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب ل 15 اسبوعا

Structured SWL (hr/sem) الحمل الدراسي المنتظم للطالب اسبوعيا خلال الفصل	78	Structured SWL (hr/w) الحمل الدراسي المنتظم للطالب اسبوعيا	4
Unstructured SWL (hr/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	Unstructured SWL (hr/w) الحمل الدراسي غير المنتظم للطالب اسبوعيا	4
Total SWL (hr/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative Assessment	Quizzes	2	10% (10)	5 and 10	A2, B1
	Assignments	2	10% (10)	2 and 12	A2, C2
	Project	1	10% (10)	Continuous	A2, B2 C2
	Report	1	10% (10)	13	A2, B2 C2
Summative Assessment	Midterm Exam	1 hr/1	10% (10)	7	A2, B1
	Final Exam	3 hrs/1	50% (50)	16	A2, A3, B1
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)		
المنهاج الأسبوعي النظري		
	Material Covered	
Week 1	1. Introduction to Petrophysics and Core Analysis	A2.1 A2.2
Week 2	2. Porosity, Rock Compressibility,	A2.1 A2.3
Week 3	Capillary Tube Models of Porous Media, Carman-Kozeny Equation, Tortuosity, Poiseuille's Law	A2.1 A2.3 B2
Week 4	Darcy's law; measurements of permeability, Fundamentals of Reservoir Fluid Flow, Types of fluids in the reservoir, Flow Regimes	A2.2 A3.1 B2
Week 5	Reservoir Geometry, Linear Flow, Horizontal Flow, Vertical Flow, Radial Flow, Spherical and Hemispherical Flow	A2.1 A2.2
Week 6 & 7	Flow in Layered Systems, Averaging Techniques Flow in Channels and Fractures	A2.1 A2.2 B1.2
Week 8	Gas flow, The Klinkenberg Effect	A2.1 A2.2 A3.3
Week 9	Reservoir Heterogeneity	A2.1 A2.2 A3.1
Week 10	Fluid Saturation, Wettability, Surface and Interfacial Tension	A2.1 A2.2 A3.2
Week 11	Capillary Pressure, Capillary Hysteresis, Leverett J-Function	A2.1 A2.2 B1.2 B2.2

Week 12	Effective and relative permeability	A2.1 ,A2.2
Week 13	Estimation of Hydrocarbons in Place, Net to Gross	A2 .1 A2.2 A3
Week 14	Project Presentation Mini Quiz	A2 C2 B3
Week 15	Two Phase Flow Through Porous Media; Linear Flow (Piston Like, Leaky Piston) Fractional Flow Equation; Buckley Leverett Equation	A2.2 A2.1

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 Texts	– Amyx, Petroleum Reservoir Engineering Physical Properties, 1960 – Tarek Ahmed, Reservoir Engineering handbook, fifth Edition, 201	Yes yes
Recommended Texts		
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.