

MODULE DESCRIPTION FORM For PETROLEUM PROPERTIES

نموذج وصف المادة الدراسية لمادة خواص النفط

Module Information			
معلومات المادة الدراسية			
Module Title	Petroleum Properties		Module Delivery
Module Type	Core	☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	PE214		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	2		Semester of Delivery
Administering Department	Petroleum Engineering	College	College of Engineering
Module Leader	Ayman Mohammed Abdullah	e-mail	aymen.m@alnaji-uni.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	Module Leader's Qualification	M.Sc
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الاخرى			
Prerequisite module		Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	This module introduces students to the fundamental physical and chemical properties of petroleum and its derivatives. It aims to develop a foundational understanding of crude oil characterization, property measurement techniques, and the implications of these properties on petroleum processing and production. Through integrated lectures and laboratory sessions, students will gain hands-on experience in evaluating petroleum samples and interpreting data relevant to refining and reservoir engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this module, students will be able to: 1. Identify and classify various types of crude oils based on chemical composition and physical properties. 2. Measure and interpret key petroleum properties including density, viscosity, vapor pressure, and thermal characteristics. 3. Analyze and evaluate crude oil quality using laboratory techniques and industry standards. 4. Explain the significance of flash point, pour point, sulfur content, and other safety-related parameters. 5. Perform fractional distillation and interpret TBP (True Boiling Point) curves for crude oil fractions. 6. Assess natural gas and oilfield water properties relevant to petroleum operations. 7. Apply laboratory skills to determine carbon residue, ash content, and water content in petroleum samples. 8. Document and report experimental findings using structured formats aligned with industry practices.
Indicative Contents المحتويات الإرشادية	Weeks 1–3: Fundamental Properties • Crude oil: chemical composition, classification, physical properties • Density, specific gravity, coefficient of expansion • Viscosity, vapor pressure, specific heat • Molecular weight, latent heat, heat of combustion Weeks 4–8: Safety and Thermal Properties • Boiling range, flash point, pour point • Sulfur content, aniline point • Penetration number, softening point Weeks 9–11: Crude Oil Evaluation • Standard evaluation techniques • Quality grading and performance indicators Weeks 12–14: Fractional Analysis • Fractional distillation and TBP curve • Fraction analysis and interpretation

	- Dehydration of crude oil Week 15: Associated Fluids - Natural gas properties - Oilfield water properties
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	- Lectures (2 hrs/week): Conceptual delivery using visual aids, real-world case studies, and interactive discussions. - Laboratory (2 hrs/week): Hands-on experiments with structured worksheets, safety briefings, and guided analysis. - Formative Assessments: Weekly quizzes, lab reports, and in-class problem-solving. - Summative Assessment: Midterm exam, final exam, and comprehensive lab portfolio. - Feedback Mechanisms: Rubric-based evaluations, peer review, and instructor feedback sessions.

Student Workload (SWL) الحمل الدراسي للطالب محسوب ل 15 اسبوعا			
Structured SWL (hr/sem) الحمل الدراسي المنتظم للطالب اسبوعيا خلال الفصل	63	Structured SWL (hr/w) الحمل الدراسي المنتظم للطالب اسبوعيا	4
Unstructured SWL (hr/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	Unstructured SWL (hr/w) الحمل الدراسي غير المنتظم للطالب اسبوعيا	2
Total SWL (hr/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

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
	Project	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative Assessment	Midterm Exam	1 hr/1	10% (10)	7	LO #1 - #7
	Final Exam	3 hrs/1	50% (50)	16	All
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction to Petroleum Properties: • Overview of petroleum origin, types, and importance • Chemical composition of crude oils • Classification methods (paraffinic, naphthenic, aromatic) • Key physical properties and industrial relevance
Week 2	Density, Specific Gravity, Coefficient of Expansion • Definitions and units • API gravity and its significance • Temperature effects on density • Measurement techniques and standards
Week 3	Viscosity, Vapor Pressure, Specific Heat • Newtonian vs non-Newtonian fluids • Viscosity-temperature relationship • Vapor pressure and volatility • Specific heat and thermal behavior
Week 4	Molecular Weight, Latent Heat, Heat of Combustion • Average molecular weight of crude fractions • Latent heat of vaporization • Combustion energy and fuel value
Week 5	Boiling Range, Flash Point, Pour Point • ASTM distillation curves • Flash point and fire hazards • Pour point and flow assurance
Week 6	Sulfur Content, Aniline Point • Types of sulfur compounds • Environmental impact and desulfurization • Aniline point and aromaticity
Week 7	Review & Integration of Thermal and Safety Properties • Summary of Weeks 4–6 • Case studies on refining and transport • Mid-module Q&A and concept reinforcement
Week 8	Penetration Number, Softening Point • Asphalt and heavy fractions • Penetration test methods • Softening point and temperature susceptibility
Week 9	Crude Oil Evaluation – Part I • API gravity, sulfur content, viscosity • Economic and processing implications • Evaluation standards and benchmarks

Week 10	Crude Oil Evaluation – Part II • TBP curve analysis • Product yield estimation • Refinery configuration impact
Week 11	Crude Oil Evaluation – Part III • Integration of lab and lecture data • Comparative evaluation of crude samples • Decision-making for refining routes
Week 12	Fractional Distillation & TBP Curve • TBP vs ASTM distillation • Curve construction and interpretation • Applications in refinery design
Week 13	Analysis of Fractions • Naphtha, kerosene, diesel, residue • Property-based classification • Product specifications and blending
Week 14	Dehydration of Crude Oil • Emulsion types and stability • Chemical and mechanical dehydration methods • Field and refinery applications
Week 15	Natural Gas & Oilfield Water Properties • Composition and heating value of natural gas • Water salinity, scaling, and treatment • Environmental and operational considerations

Delivery Plan for Lab (Weekly Syllabus)

المنهاج الأسبوعي العملي

	Material Covered
Week 1	Lab Orientation • Safety protocols and PPE usage • Introduction to lab equipment and procedures • Overview of lab manual and reporting format
Week 2	Density Measurement • Determination of density and specific gravity using hydrometers and pycnometers • Temperature correction procedures • Data recording and error analysis
Week 3	Viscosity Determination • Use of viscometers (Saybolt, Redwood, or rotational) • Calibration and repeatability • Graphing viscosity vs temperature
Week 4	Distillation – Setup & Calibration • Introduction to distillation apparatus • Sample preparation and safety checks • Initial boiling point determination

Week 5	Distillation – Boiling Range Analysis • Conducting full-range distillation • Recording temperature-volume data • Constructing boiling range curves
Week 6	Distillation – Continued • Repeat distillation with different crude samples • Comparative analysis • Discussion of anomalies and errors
Week 7	Distillation – Finalization & Reporting • Final distillation runs • Lab report preparation and peer review • Submission of boiling range analysis
Week 8	Pour Point Measurement • Cooling curve method • ASTM D97 procedure • Interpretation of results
Week 9	Flash Point Testing • Closed cup and open cup methods • Safety precautions • Data interpretation and classification
Week 10	Water Content Determination – Part I • Karl Fischer titration or distillation method • Sample handling and accuracy • Reporting format
Week 11	Water Content Determination – Part II • Repeat testing with different samples • Error analysis and discussion • Submission of water content report
Week 12	Carbon Residue Determination – Part I • Conradson or Ramsbottom method • Sample preparation and heating protocol • Residue quantification
Week 13	Carbon Residue Determination – Part II • Repeat testing • Comparative analysis • Discussion of implications
Week 14	Ash Content Determination • Furnace method • Sample weighing and residue analysis • Final lab report preparation
Week 15	Final Water Content Review & Wrap-Up • Final testing and data consolidation • Comprehensive lab portfolio submission • End-of-module feedback and reflection

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	The Properties of Petroleum Fluids, 2 nd edition by William D. McCain Jr.	Yes
Recommended Texts	Petroleum Refinery Engineering by W.L. Nelson SPE Petroleum Engineering Handbook	Yes
Websites	https://onepetro.org/	

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.				
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