Course Information

Course Number:	PETE 311
Course Title:	Reservoir Petrophysics
Sections:	505 and 506
Time:	12:40 pm-1:30 pm (Monday & Wednesday)
Location:	Richardson 302
Credit Hours:	3 (2 lecture hours, 3 lab hours)

Instructor Details

Instructor:	Dr. Wencheng Jin
Office:	Richardson 401F
Phone:	979-458-7672
Email:	wencheng.jin@tamu.edu
Office Hours:	1:30 pm -2:30 pm, Monday &Wednesday

Course Description

Systematic theoretical and laboratory study of physical properties of petroleum reservoir rocks: lithology, porosity, elastic properties, strength, acoustic properties, electrical properties, relative and effective permeability, fluid saturations, capillary characteristics, and rock-fluid interactions such as adsorption and absorption.

Course Prerequisites

Grade of C or better in MATH 251, PHYS 207, and ENGR 217 or PHYS 217.
Grade of C or better in CHEM 107, CHEM 117, and GEOL 104, or concurrent enrollment.

Laboratory Sections

Section 505: Monday 09:30 AM-12:20 PM; Location: Richardson 212
Section 506: Wednesday 03:00 PM-05:50 PM; Location: Richardson 212

Course Learning Outcomes

At the end of the course, students will be able to…	*Program Outcome No.*
Define porosity, discuss the factors which affect porosity; Describe laboratory and field measurement methods to determine porosity; Conduct experiments determining values of porosity	1, 5, 6
Define electrical properties of rock, resistivity index, saturation exponent, and cementation factor; show their relationship and uses;	1, 2
Conduct experiments to measure the electrical properties of rocks, and demonstrate the calculations necessary in analyzing laboratory measurements.	1, 5,6
Define permeability and its determinants; describe the methods of measurements; Conduct lab experiments to measure hydraulic conductivity, liquid and gas permeability, and demonstrate the calculations necessary in analyzing laboratory data.	1, 2, 5, 6

Reproduce the Darcy equation in a differential form, explain its meaning, integrate the equation for typical reservoir systems, and calculate the effect of fractures and channels	1, 2, 7
Explain surface/interfacial tension and wettability and their effect on capillary pressure, describe the methods of determining capillary pressure, and convert laboratory capillary pressure values to reservoir conditions	1, 2, 5, 6
Describe the method of determining fluid saturations in reservoir rock and show the relationship between fluid saturation and capillary pressure	1, 5
Define effective and relative permeability; reproduce typical relative permeability curves, and show the effect of saturation history on relative permeability	1, 2
Define elastic and acoustic properties of the rocks, the rock strength, and the factors affecting them, and identify stress-strain diagrams for brittle and ductile rocks	1, 2
Write concise engineering lab reports.	3
Demonstrate and practice proper lab safety practices.	6

Related Student Outcomes:

No.	PETE students by the time of graduation must have…
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	an ability to communicate effectively with a range of audiences
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Textbook and/or Resource Materials

No textbook or other resource materials are required for the course. However, the following material is suggested for further reading:

- Tiab, D. and Donaldson, E.C. 2004 *Petrophysics: Theory and Practice of Measuring Reservoir Rock and Fluid Transport Properties*, 2nd edition, Elsevier, New York;
- Schon, J.H. 1996. *Physical Properties of Rocks: Fundamentals and Principles of Petrophysics.* 2nd edition, Pergamon Press, New York.

Grading Policy

Grading items

	Weight [%]
Lab Attendance & Report	30
Midterm Exam 1	20
Midterm Exam 2	20
Final Exam	30
3 Mins Presentation	5
Total	105

Grading scale

A	>= 90%
B	80% - 89.9%
C	70% - 79.9%
D	60% - 69.9%
F	< 60%

Notes

- The midterm exams will only cover the new material learned from the previous exam; the final exam is cumulative.
- All Exams will be closed-book, closed-note, and closed-device. Students may use an approved scientific calculator. WIFI or Bluetooth-connected devices, including cell phones and watches, must be silenced (not vibrate) and stored in book bags. Students are allowed 1 page (8.5" by 11", single-sided) of handwritten notes for Midterm #1 & #2 and 1 page (double-sided) for the Final Exam.
- Lab reports are due **before** the following lab session.
- 3 Mins Presentation: 3 mins in 3 slides presentation with content on contemporary news/research articles, etc. that demonstrate the application of petrophysics and its importance:
  - 5 bonus points, highly encouraged, but not mandatory!
  - A sign-up sheet will be provided in Canvas.
  - The presentation starts in the 7th week, with a maximum of 2 presentations per lecture class, at the start of the lecture.
  - Peer Evaluation (Score 1-5 with one sentence justification on at what scale his/her presentation motivates you in the class content), final score = weighted average from all peers (50%) and the instructor (50%)

Course Policies

Attendance: It is the students' responsibility to attend the class. Attendance and active participation in class are expected. ***Unannounced quizzes will happen at the beginning or at the end of lecturing class. All quizzes together will count as one Lab.***

Lap Reports: *Lab reports may be submitted up to 24 hours late on Canvas for a 20% grade penalty. Lab reports will not be accepted more than 24 hours late without prior written approval of the instructor for an approved reason*. ***You can dispute your graded Lab within a week of its return to students. You are responsible for verifying your grade as posted on Canvas within this one-week period.*** *Work submitted by a student as makeup work for an excused absence is not considered late work and is exempt from the late work policy (Student Rule 7).*

Work Quality: A Neat, legible, systematic, and complete presentation is required in lab reports and examinations for full credit. Units and explanations must be written wherever appropriate for the answers.

AI: You may use university-approved AI tools to assist with creating graphs, tables, and refining your writing for lab reports. A disclosure statement—clearly identifying the tools used and how they were applied—must be included at the end of your report.

Exams: Examinations are not optional. Make-up examinations will be given only for university excused absences. It is the student's responsibility to notify the instructor within 24 hours of the absence to make arrangements. ***All exam grades are final one week after being posted on Canvas.***

Feedback: After each Midtern exam, I will be asking you to give me feedback on your learning in informal ways so we can create a better learning experience. Feel free to contact me anytime with feedback, concerns, suggestions, etc.

Academic Dishonesty: Collaboration on exams is forbidden except when specifically authorized. Students violating this policy may be given an F in the course. See http://www.tamu.edu/aggiehonor.

Course Schedule

Tentative Course Schedule: *Any updates will be posted in Canvas.*

Week	Day	Date	Lecture Topic
1	M	08/25/2025	Introduction
	W	08/27/2025	Porosity - definition, impacting factors
2	M	09/01/2025	No Class, Labor Day
	W	09/03/2025	Porosity - classification, saturation
3	M	09/08/2025	Porosity - lab measurement
	W	09/10/2025	Porosity - field measurement
4	M	09/15/2025	Resistivity - fundamentals
	W	09/17/2025	Resistivity - impacting factors
5	M	09/22/2025	Resistivity – Archie's law
	W	09/24/2025	Resistivity - measurement exercise
6	M	09/29/2025	**Review Session**
	W	10/01/2025	**Midterm Exam #1**
7	M	10/06/2025	Permeability - definition, impacting factors, $\phi - \kappa$. relationship, anisotropy
	W	10/08/2025	Permeability - Darcy's law

8	M	10/13/2025	No Class, Fall Break
	W	10/15/2025	Permeability - effective permeability of ideal models
9	M	10/20/2025	Permeability - fracture permeability, statistical quantification
	W	10/22/2025	Permeability - single-phase flow
10	M	10/27/2025	Permeability - liquid and gas (steady state) measurements, Klingenberg effect
	W	10/29/2025	Permeability- measurements (transient, oscillatory), saturation measurement
11	M	11/03/2025	**Review Session**
	W	11/05/2025	**Midterm Exam #2**
12	M	11/10/2025	Multiphase flow - effective permeability, surface/interfacial tension
	W	11/12/2025	Multiphase flow - wettability, contact angle
13	M	11/17/2025	Multiphase flow - wettability measurements, capillary pressure
	W	11/19/2025	Multiphase flow - capillary pressure measurement
14	M	11/24/2025	Multiphase flow - relative permeability
	W	11/26/2025	No Class, Reading Day
15	M	12/01/2025	Geomechanics – Brittle v.s. ductile, hysteresis effect
	W	12/03/2025	Geomechanics – Elastic Constants, P/S waves
16	M	12/08/2025	**Review Session**
	W	12/10/2025	No Class, Reading Day
17	M	12/15/2025	**Final Exam**

Tentative Laboratory Schedule

The order of the lab sessions is subject to change due to equipment preparation; please refer to Canvas for any updates.

Week	***Topic***
1	No Lab, First Week
2	Lab safety, Core Dimensions, Liquid Density, and Acid Test
3	Rock Texture and Porosity
4	Rock Porosity Measurement
5	Rocks Mineralogy, Grains Density and Settling Velocity
6	No Lab, Midterm Exam
7	Electrical Properties of Reservoir Rocks
8	No Lab, Fall Break
9	Determination of Hydraulic Conductivity

10	Determination of Permeability using Liquid
11	Determination of Permeability using Gas
12	No Lab, Midterm Exam
13	Surface tension
14	Unconfined Compression Test on Rock Samples
15	No Lab, Final Week
16	No Lab, Final Week
17	No Lab, Final Week

University Policies

This section outlines the university level policies that must be included in each course syllabus. The TAMU Faculty Senate established the wording of these policies.

***NOTE**: Faculty members should not change the written statements. A faculty member may add separate paragraphs if additional information is needed.*

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (Student Rule 7, Section 7.4.1).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

Texas A&M at College Station
You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

Texas A&M at Galveston
You can learn more about the Honor Council Rules and Procedures as well as your rights and responsibilities at tamug.edu/HonorSystem.

Texas A&M at Qatar
You can learn more about academic integrity and your rights and responsibilities at Texas A&M University at Qatar by visiting the Aggie Honor System website.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below) Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Texas A&M at College Station
Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu.

Texas A&M at Galveston
Disability Resources is located in the Student Services Building or at (409) 740-4587 or visit tamug.edu/counsel/Disabilities.

Texas A&M at Qatar

Disability Services is located in the Engineering Building, room 318C or at +974.4423.0316 or visit https://www.qatar.tamu.edu/students/student-affairs/disability-services.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see University Rule 08.01.01.M1):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Texas A&M at College Station
Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with Counseling and Psychological Services (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's Title IX webpage.

Texas A&M at Galveston
Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with the Counseling Office in the Seibel Student Center, or call (409)740-4587. For additional information, visit tamug.edu/counsel.

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the Galveston Campus' Title IX webpage.

Texas A&M at Qatar
Texas A&M University at Qatar students wishing to discuss concerns in a confidential setting are encouraged to visit the Health and Wellness website for more information.

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's Title IX webpage.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing available resources and services on your campus

Texas A&M College Station
Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org Links to an external site..

Texas A&M at Galveston
Students who need someone to talk to can call (409) 740-4736 from 8:00 a.m. to 5:00 p.m. weekdays or visit tamug.edu/counsel for more information. For 24-hour emergency assistance during nights and weekends, contact the TAMUG Police Dept at (409) 740-4545. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org Links to an external site..

Texas A&M at Qatar
Texas A&M University at Qatar students wishing to discuss concerns in a confidential setting are encouraged to visit the Health and Wellness website for more information.

Campus-Specific Policies

Texas A&M at Galveston

Classroom Access and Inclusion Statement

Texas A&M University is committed to engaged student participation in all of its programs and courses and provides an accessible academic environment for all students. This means that our classrooms, our virtual spaces, our practices and our interactions are as inclusive as possible and we work to provide a welcoming instructional climate and equal learning opportunities for everyone. If you have an instructional need, please notify me as soon as possible.

The Aggie Core values of respect, excellence, leadership, loyalty, integrity and selfless service in addition to civility, and the ability to listen and to observe others are the foundation of a welcoming instructional climate. Active, thoughtful and respectful participation in all aspects of the course supports a more inclusive classroom environment as well as our mutual responsibilities to the campus community.

The following statements below are optional. Leave as is to include, or delete if preferred. Either way, delete this note.

Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. Currently enrolled students wishing to withhold any or all directory information items may do so by going to howdy.tamu.edu and clicking on the "Directory Hold Information" link in the Student Records channel on the MyRecord tab. The complete FERPA Notice to Students and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees honors and awards received, participation in officially recognized activities and sports, medical residence location and medical residence specialization.