

PETE 4090- Unconventional Hydrocarbon Reservoirs

Course Syllabus

Spring 2017

Instructor

Dr. Arash Dahi Taleghani

Office: Old Forestry Bldg. 139

E-mail: a_dahi@lsu.edu

Office hours: T 2:30 – 3:30PM.

Lecture Time

M - W 6:00-7:20 pm

A. DESCRIPTION

The course starts with a general overview of different type of unconventional reservoirs and their geological and petrophysical properties. Then due to the significance of natural fractures in economic production from these reservoirs, special attention will be given to natural fractures characterization. In the next step, drilling and completion techniques adopted for these formations will be discussed. In the second part of the course, the emphasis will be on hydraulic fracturing design and collecting data (such as in situ stresses and rock mechanical properties) for a proper fracture design. Injection tests and Nolte-Smith analysis will be introduced toward the end of the course for fracture assessment purposes. The course will be finished with an overview of fractured well productivity analysis and decline curve analysis in unconventional oil and gas reservoirs.

B. COURSE OBJECTIVES

1. To introduce students to different types of unconventional reservoirs and their geological properties.
2. To introduce students to principles governing hydraulic fracturing propagation and their implication on treatment design.
3. To learn the impact of fracturing on production enhancement and ultimate recovery and differences of decline curve analysis in unconventional reservoirs from conventional reservoirs.
4. To introduce students to different injection tests and techniques to determine formation properties required for designing hydraulic fracturing treatments.

5. To provide students with opportunities to assess real frac jobs implemented in the field and prepare a recommendation to improve future treatments in a specific field including its complete design.
-

C. COURSE TOPICS

The course will cover the following topics:

1. Geology of Unconventional reservoirs
 2. Petrophysical properties of Shale gas and shale oil
 3. Introduction to hydraulic fracturing treatment
 4. Rock Mechanics and Elasticity principles
 5. Natural fractures and their role in UGR
 6. In situ stress and rock mechanical properties
 7. Near wellbore issues
 8. Fracture height prediction
 9. Hydraulic Fracture Geometry
 10. Horizontal and deviated well fracturing
 11. Fracturing Fluid (Rheology and Constitutive laws)
 12. Proppant and proppant transport
 13. Fluid Leak-off models
 14. Coupled Models for modeling hydraulic fracturing process
 15. Hydraulic Fracture evaluation – diagnostics issues
 16. Design issues
 17. Fractured Well Performance - Radial flow
 18. Pressure decline analysis
 19. Reserve Estimation in UGS
-

D. TEXT AND REQUIRED SUPPLIES

M. Smith and C. Montgomery, Hydraulic Fracturing published by CRC Press 2015

Other References

Several SPE and AAPG papers (will be posted later)
Handouts (Distributed only during the lectures)
Halliburton Cement Handbook
API Guideline

Recommended Reading Materials

Reservoir Stimulation, Michael J. Economides, 3rd Edition, Wiley, 2000.

Design and Appraisal of Hydraulic Fractures, 2009, Jack R. Jones and Larry K. Britt, ISBN: 978-1-55563-143-7, Published by SPE.

Petroleum Engineering Handbook, Volume VI: Emerging and Peripheral Technologies, 2007, Edited by: H.R. Warner Jr.

Recent Advances In Hydraulic Fracturing, Edited by: John L. Gidley, Stephen A. Holditch, Dale E. Nierode and Ralph W. Veatch, SPE Monograph Series Vol. 12.
Mechanics of Hydraulic Fracturing, Yew, Gulf Professional Publishing.
Hydraulic Fracture Mechanics, Peter Valko, Michael J. Economides.

E. GRADING PLAN

Coursework will be weighted as follows:

Mid-term Exams	30%
Quizzes	15%
Final Exam	35%
Homework	20%

QUIZZES:

There will be many drawing-type and other quizzes (probably one almost every class period). Quizzes will relate to current *and previous* topics. A quiz may be given at *anytime* during any class period -- immediately after a lecture, at the beginning or end of a class, etc. There will be no make-up quizzes or exam -- none even later during the same class period. Quizzes will be given only to those students who are present when the quizzes are passed out. Regarding regrading, you have one week after grades release to request regrading by meeting the instructor or notifying him by email.

FINAL EXAM:

The final exam will be comprehensive and open book. It will be given at the time shown at the end of the schedule that follows.

F. CLASSROOM RULES OF CONDUCT

Misconduct / Dishonesty

Any kind of misconduct and dishonesty will be reported to the Department Chairman, the Dean of Engineering, and/or the Dean of Students in writing. This includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, and any act designed to give an unfair academic advantage to the student. Then the case will be investigated by the University and the students have the right to appeal to the University. Further information can be found at <http://www.geol.lsu.edu/StudentInfo/BSDegree/LSUAcademicMisconduct.pdf>

Disability Services

If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please see an advisor in the Office of Disability Services (112 Johnston Hall) so that such accommodations may be arranged. After you receive your accommodation letters, please see the instructor as soon as possible to discuss the provisions of those accommodations.

Other Important University Policies

All students are required to read and be familiar with the Code of Student Conduct found at www.lsu.edu/judicialaffairs as well as all other University policies and procedures.

G. EMERGENCY PROCEDURES

1. Evacuation procedures -- see instructions posted in the classroom.
 2. First aid kit -- located in Room. All instructors have a key to the room.
 3. Emergency ambulance -- from any instructor's office, phone "9" to get an outside line, then "911." There are also phones on other floors and at the bookstore and nurse's office on the ground floor.
 4. Campus security -
-

H. YOUR IDEAS, EVALUATIONS, ETC.

In general, your ideas, comments, suggestions, questions, grade challenges, etc. are welcome. Your discretion in these matters is expected, however. No part of your grade will be based on anything other than your coursework and attendance.

You are encouraged to take advantage of instructor office hours for help with coursework or anything else connected with the course and your progress.