Course Description: Natural fractures are increasingly recognized as dominant permeability paths in many reservoirs. Unfortunately, there are few guidelines available for geologists and engineers characterizing and engineering naturally fractured reservoirs. This course is intended as an up-to-date summary of an integrated reservoir study including characterization, experimentation and integration of information in determining the most suitable process option in naturally fractured reservoirs. Most of the information originates from a CO2 pilot in the naturally fractured Spraberry Trend Area in West Texas. Information presented from this project in this course include: core results from several wells including a horizontal core; measurement of fracture populations and spacings from core data; investigation of diagenesis in natural fractures; evaluation of fracture detection logs; detailed study of matrix porosity; evaluation of shaly-sand algorithms for calculation of net pay; measurement of in-situ oil saturation with sponge cores; laboratory measurement of imbibition, capillary pressure and wettability at reservoir conditions, history matching laboratory measurements for up-scaling to reservoir geometry, wettability data for prediction of waterflood performance; reservoir performance analysis during water injection, and laboratory experiments of forced and free-fall gravity drainage with CO2 and use of commercial simulators to match reservoir performance using precisely measured lab and field data.

Credit Hours: 3

Instructor: Dr. David Schechter, Associate Professor
401Q Richardson, 845-2275, david.schechter@pe.tamu.edu
Office hours: by appointment

Class hours:

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Instructor</th>
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<tr>
<td>TR 12:45 – 2:00 (RICH 208)</td>
<td>D.S. Schechter</td>
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Text:

Author: Wayne Narr, David S. Schechter, Laird B. Thompson
Format: softcover
Pages: 115
ISBN: 978-1-55563-112-3
Publisher: Society of Petroleum Engineers
Year Published: 2006
Item Number: 100-1723
Course Policies:

• **Attendance:** Attendance in class is expected. If an illness or unexpected event prevents attendance, the student should notify the instructor before class. Students should read assigned reference material in advance and be prepared for exams and class discussions.

• **Late Work:** Laboratory reports are due at the beginning of class on the assigned due date, unless otherwise stated. Late work turned in within one week after the due date and time will be assessed a 30-point penalty. Thereafter, a 15-point penalty per week will be assessed.

• **Work Quality:** Neat, legible, systematic and complete presentation is required in assignments, quizzes and examinations for full credit. Units (for example, Newton-meters) must be written wherever appropriate for the answers. Reports should be free of spelling and grammatical errors. Plots should contain properly-labeled axes (quantity and units) as well as a legend to distinguish between multiple curves.

• **Grading:** The regular university grading scale will be used. Weights will be assigned as follows:
  - Quizzes: 30%
  - Research Project: 60%
  - Participation, professionalism: 10%

• **Academic Dishonesty:** Collaboration on examinations and assignments is forbidden except when specifically authorized. Students violating this policy may be removed from the class roster and given an F in the course or may be assessed other penalties as outlined in the Texas A&M University Student Rules.

• **Team Exercises:** The course may include some team exercises. Collaboration within teams is required; collaboration between teams is forbidden except when specifically authorized. Team reports will be assigned a team grade. Each team member will receive the team grade, multiplied by a Participation Factor. The Participation Factor will be determined by a combination of peer reviews and instructor assessment.

Course Schedule

**Week** | **Topic**
---|---
1 | Introduction to naturally fractured reservoirs
2 - 3 | Fracture Characterization: Geophysical and Geological Aspects, Petrophysical and logging evaluation of naturally fractured reservoirs
4 - 5 | Modelling of fractured reservoirs: Defining the fracture system, static characterization of fracture system, well test analysis in fractured reservoirs
5 - 6 | Reservoir Engineering: Issues in reservoir engineering in naturally fractured reservoirs, material balance, fracture vs. matrix porosity, relative permeability and capillary pressure,
| 7 - 8 | Simulation of naturally fractured reservoirs: Issues in simulation, single vs. dual porosity simulation, input parameters from static model and fracture characterization, sensitivity of simulation to fracture parameters |
| 9 - 10 | Case Histories: Case history of primary, secondary and enhanced oil recovery projects world-wide |
| 11 | Project Management: Development of project management strategies for naturally fractured reservoirs |
| 12 | Final Presentations |