UNCONVENTIONAL OIL AND GAS RESERVOIRS
PETE 612
Tentative Syllabus and Administrative Procedures
Fall 2009

Class Meetings: T,TH; 9:35 – 10:50 a.m., RICH 302
Instructor: Walter B. Ayers, Ph.D., CPG
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Office Hours: M: 3:30-4:30 p.m.; Th.: 3:30-4:30 p.m.; other hours by appt. or when door is open

As we deplete conventional oil and gas reserves, “unconventional” energy resources are increasingly important to US and international energy supplies. Today, for example, coal beds, shales, and low-permeability (tight) sandstones, combined, account for more than 40% of the U.S. natural gas supply. Moreover, in 2006, U.S. production of coalbed methane, alone, exceeded 1.7 trillion cubic ft (Tcf), which was 9.5% of the total dry gas production, and coalbed methane reserves were 19.9 Tcf, which was 9.8% of the total U.S. dry gas reserves. Internationally, there are tremendous heavy oil resources in Eastern Venezuela, Western Canada, and other areas, and we are just beginning to exploit these resources.

While resources of unconventional hydrocarbons are very large, economically recoverable volumes (reserves) are much smaller, because the greater costs and additional technology required for production. Many unconventional reservoirs have low matrix permeability, and natural fractures may be necessary for economic production rates. Therefore, optimal development of many unconventional reservoirs requires knowledge of the optimal completions and stimulation methods for low-permeability reservoirs, as well as understanding of the role of natural fractures in fluid flow. Finally, the increased dependence on natural gas for generation of electricity in the U.S. necessitates increased storage capacity near consumers to meet peak demands. Thus, understanding of the geologic and engineering aspects of gas storage reservoirs is vital for optimum resource management.

The objectives of this course are to familiarize students with the unique aspects of unconventional gas and oil reservoirs, including their (1) economic significance (2) geologic occurrences, (3) controls on production, (4) drilling and completion practices, (5) reservoir management, and (6) present activity.

Text and Materials: There is no assigned textbook. Materials will come from a variety of current reports, published texts, and papers. Reference materials and reading assignments will be handed out, placed on a website, or referred to by location.

Selected References:
UNCONVENTIONAL OIL AND GAS RESERVOIRS
Petroleum Engineering 612
Syllabus and Administrative Procedures
Fall 2009

Basis for Grades:

Report (20%) and Presentation (10%) (includes, peer evaluations).............30 percent
Homework, Quizzes, Critiques, and Other Assignments..........................25 percent
Midterm Examination (October 22; in class)...........................................20 percent
Final Examination (December 11, 12:30-2:30 p.m.).................................20 percent
Participation .........................................................................................5 percent

Total = 100 percent

Grade Cutoffs: (Percentages)

A: ≥ 90  B: 89.99 to 80  C: 79.99 to 70  D: 69.99 to 60  F: ≤ 59.99

Student Papers and Presentations (SUBJECT TO REVISION)

Working in teams, students will write reports and make presentations on topics covered in the course. Topics will be assigned by 24 September, and preliminary outlines are due 13 October. Reports will be submitted in both paper and digital formats, following either SPE or AAPG publication guidelines. Text of reports will be 10-20 double-spaced pages; tables and figures may be either embedded in the text or placed at the end, following the references. Reference papers used to prepare reports will be submitted as pdf files. All reports will be due by 5 p.m. on 8 December. Peer reviews will be done at the time that you submit the reports. Presentations will be made using PowerPoint software, and students will submit presentations for posting on the class share drive. All reports and presentations will be posted and will be available to you.

Homework, Quizzes, Critiques, and Other Assignments

There will be several quizzes and homework exercises during the semester. Also, you may be asked to write one-page critical reviews of published articles pertinent to the class material.

Policies and Procedures

1. Students are expected to attend every class.
2. All work shall be done in a professional manner; work shall be as complete as possible.
3. Policy on Grading
   a. Homework and exams will be graded on the basis of answers only — partial credit, if given, is given solely at the discretion of the instructor.
   b. All work requiring calculations shall be properly and completely documented for credit.
   c. All grading shall be done by the instructor, or under his direction and supervision, and the decision of the instructor is final.
4. Policy on Regrading
   a. Only in very rare cases will work be considered for regrading; e.g., when the total number of points deducted is not consistent with the assigned grade. Partial credit (if any) is **not** subject to appeal.
   b. Work that, while correct, cannot be followed, will be considered incorrect and will not be considered for a grade change.

5. The grade for a late assignment is **zero**. Homework will be considered late if it is not turned in at the start of class on the due date. Late or not, all assignments must be turned in. A course grade of **Incomplete** will be given if any assignment is missing, and this grade will be changed only after all required work has been submitted.

6. Each student should review the University Regulations concerning attendance, grades, and scholastic dishonesty. Anyone caught cheating on an examination or collaborating on an assignment where collaboration is not specifically allowed may be removed from the class roster and given an F (failure grade) in the course.

**Course Description**

**Introduction to Unconventional Energy Resources**
- What are unconventional resources?
- Where do they occur?
- Economic significance of each
- Technical, economic, political, and environmental constraints on development

**Petroleum Systems (review)**
- Systematic approaches to resource assessment
- Hydrocarbon origin
- Hydrocarbon migration
- Hydrocarbon entrapment

**Natural Fractures (review)**
- Importance in unconventional reservoirs
- Origin, occurrence, and predictability
- Fracture effects on HC storage, porosity, and permeability
  - Permeability anisotropy
  - Coning
  - Breakthrough
  - Boundaries
- Roles in exploration
- Roles in reservoir management - primary and enhanced recovery
- In-situ stress - importance in unconventional reservoir performance
- Classification of fractured reservoirs
Low-permeability (Tight) Sands
- Occurrences, resources, reservoir characteristics
- Drilling and completion methods
- Facilities, reservoir management, limitations on development, present activity

Coalbed Gas
- Occurrences, resources, reservoir characteristics
- Drilling and completion methods
- Facilities, reservoir management, limitations on development, present activity
- Water and environmental issues

Shale Reservoirs (Gas and Oil)
- Occurrences, resources, reservoir characteristics
- Drilling and completion methods
- Facilities, reservoir management, limitations on development, present activity
- Water and environmental issues

Heavy Oil
- Occurrences, resources, reservoir characteristics
- Drilling and completion methods
- Facilities, reservoir management, limitations on development, present activity
- Environmental issues

Gas Hydrates
- Occurrences, resources, reservoir characteristics
- Recovery methods
- Limitations on development, present activity
- Environmental issues

Gas Storage
- Types and locations of gas storage reservoirs
- Technical issues and terminology
- Gas storage volumes and economics

Other Unconventional Energy Resources and Issues That May be Addressed
- Geothermal Energy
- Coal – Conversion to Gas
  - Coal-to-gas
  - In-situ gasification

Americans with Disabilities Act (ADA) Policy Statement
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Disability Services in Room B118 of Cain Hall, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu)
Coursework Copyright Statement (Texas A&M University Policy Statement)

The handouts used in this course are copyrighted. By "handouts," this means all materials generated for this class, which include but are not limited to syllabi, quizzes, exams, homework, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy them, unless you are expressly granted permission.

As commonly defined, plagiarism consists of passing off as one’s own the ideas, words, writing, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions about plagiarism and/or copying, please consult the latest issue of the Texas A&M University Student Rules, under the section "Scholastic Dishonesty.

“Aggie Honor Code”

“An Aggie does not lie, cheat, or steal or tolerate those who do.” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: www.tamu.edu/aggiehonor/ On all submitted course work, assignments, and examinations in this class, recognition and acceptance of the following Honor Pledge is implicit in the student’s signature on the class materials: “On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work.”