Graduate Program Review

February 2014

Harold Vance Department of Petroleum Engineering
Texas A&M University
College Station, TX 77843-3116
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Charge to the Peer Review Team

I write to provide you with background on the Department of Petroleum Engineering at Texas A&M University and to explain the expectations for the external review.

In 1928-29 the Board of Directors approved plans to establish a course in petroleum production engineering at Texas A&M University, the first in the State. Petroleum Engineering courses were offered for the first time in 1929. In 1949, Dr. Harvey T. Kennedy spearheaded the development of a graduate program in petroleum engineering. The first M.S. degree was conferred in 1951 and the first Ph.D. was conferred in 1953.

Although this review is part of a periodic review of all Texas A&M University graduate programs, this type of review offers an excellent opportunity to identify ways to maintain the current high standards of the programs and to learn from review team members’ experiences with similar programs.

Please examine the department and its programs and make recommendations that will help in planning improvements. Your resources are a self-study report prepared by the department, copies of materials from the program’s last review, information you gain through personal interactions while visiting Texas A&M University, copies of strategic plans and goal-setting documents at the department, college, and/or university level, and any additional information requested by you or by the department. Within the broad charge of recommending ways the department can continue to improve are some specific questions that we would like you to address:

- Based on the data / information provided in the self-study report or gathered by the review team, what are the department’s overall strengths and weaknesses?

- How well do the department’s strategic goals align with those of its college and with those of Texas A&M University?

- How would you compare this department with its peers?

- What improvements (including student learning and faculty development) has the department made since the previous program review?

- With only current resources or a modest infusion of new ones, what specific recommendations could improve the department’s performance, marginally or significantly?

I look forward to meeting with you and the entire committee on March 30-April 1. If you have any questions or require additional information, please do not hesitate to let me know.

A. Daniel Hill
Department Head
Brief History of the Petroleum Engineering Program

Founding of the Department

In 1928-29 the Board of Directors approved plans to establish a course in petroleum production engineering at A&M, the first in the State. Petroleum Engineering courses were offered for the first time in 1929. The Department of Petroleum Engineering awarded its first bachelor’s degree in 1931. In 1949, Dr. Harvey T. Kennedy spearheaded the development of the graduate program in petroleum engineering. The first M.S. degree was conferred in 1941 and the first Ph.D. was conferred in 1953.

Professor J. Berry Joyce was selected to head the new Department. Joyce had received a B.S. in electrical engineering from Texas A&M in 1917 and had done additional work at Cornell. He had about 10 year’s industrial experience with the Waggoner Oil Company in various phases of the petroleum industry. Since much of his experience has been in exploration and drilling, the curriculum was largely mechanical engineering slanted toward drilling. Professor R. L. Mills was employed in 1930 and when Joyce resigned in 1933 he served as Acting Department Head during 1933-34.

Because of the increasing rate of petroleum discovery in the State, the curriculum attracted increasing numbers of students, necessitating modern physical plant facilities and faculty expansion. The Petroleum Engineering and Engineering Experiment Station and Geology Building was completed in 1933. In 1934 Professor Harold Vance was selected to head the Petroleum Engineering Department. Vance held the B. S. in petroleum engineering from the University of California. He had broad geological and petroleum engineering experience in service with the U.S. Bureau of Mines, the Marland Oil Co. (later Continental Oil Co.) and as a consulting engineer and independent oil producer. Professor Albert B. Stevens also joined the Department in 1934. Stevens held a B.S. in petroleum engineering from the University of California and an M.S. in petroleum engineering from the University of Southern California. Mr. Stevens also had petroleum experience with the Gypsy Oil Company (Gulf Oil Corp.) and the Standard Oil Co. of California. These two men developed the curriculum to include not only drilling engineering but also oil and gas production and natural-gas engineering. They planned and constructed laboratory facilities to support this program. The four-year curriculum was accredited by the Engineers Council for Professional Development in 1936 when accreditation was initiated. Five-year curricula were developed and were approved by ECPD. The enrollment continued to increase and reached a maximum of 814 prior to World War II. Because of the large undergraduate enrollment and the rapid technological development within the petroleum industry in this period there was little time for development of a graduate program.

The influx of veterans after World War II, the rapid acceleration of exploration for petroleum and the need for research prompted the Board of Directors to several actions. First, the Texas Petroleum Research Committee (TPRC) was formed in 1947 as a consortium between the Railroad Commission of Texas, the University of Texas and Texas A&M. The purpose of TPRC was to conduct research directed to increasing the recovery of oil and gas from Texas fields. Research divisions were established at the University of Texas and Texas A&M and were funded by the respective universities. In 1951 the Railroad Commission of Texas requested $100,000 per year for such research and the monies were appropriated by the State Legislature.
Concurrent with this action the Board of Directors established its first Distinguished Professorship in 1949. The recipient was Dr. Harvey T. Kennedy, scientist and researcher. Dr. Kennedy had 10 years of experience with the Bureau of Standards followed by 20 years with the Gulf Research & Development Company, Pittsburgh, Pa. Dr. Kennedy promptly set about developing a graduate program in petroleum engineering which has evolved into one of the most productive programs in the country.

The Department continued to enjoy good undergraduate enrollment and expanding graduate enrollment and research. In 1953 Vance resigned as Department Head and Albert B. Stevens assumed the position.

In 1953 Stevens resigned and Robert L. Whiting was appointed Head of the Department. Whiting had earned B. S. and M.S. degrees in petroleum engineering from the University of Texas. He joined the faculty in 1946 after industrial experience with the Railroad Commission of Texas and Stanolind Oil and Gas Company (later AMOCO Production Co.) and after a year as associate professor of petroleum engineering at the Missouri School of Mines.

In 1954 the Department initiated an Advanced Level Continuing Education Program in petroleum engineering. This was expanded to encompass two-week courses in petroleum reservoir engineering, advanced petroleum reservoir engineering, advanced drilling engineering, recovery methods, well-completion and testing and well-log interpretation. Over 600 petroleum industry personnel from virtually all the countries in the world have attended these courses.

Petroleum engineering curricula of the Department were broadened to include all aspects of petroleum reservoir engineering encompassing both primary and enhanced recovery. The depth of coverage of drilling, production and natural gas engineering was increased.

With growth of the Department and its expanding research activities the Board of Directors in 1957 approved construction of a new petroleum engineering building, the W.T. Doherty Petroleum Engineering Building. The building was finished in time for the opening of the 1960-61 academic year. Because of continued growth, the Joe C. Richardson Jr. Petroleum Engineering Building was built and completed in 1990. The 10-story building contains spacious study rooms with computer facilities, classrooms, and laboratories.

Professor R. L. Whiting resigned as Head of the Department on February 29, 1976 and Dr. W. D. Von Gonten succeeded him on March 1, 1976. Von Gonten died in 1991 and Kenneth R. Hall was appointed Temporary Head until James E. Russell was named as Interim Head. Russell served as Interim Head from 1991-1992 and was appointed Head in 1992. Russell served as Head until 1996. Hans Juvkam-Wold served as Interim Head from 1996-1997. Charles H. Bowman was named the new Head in 1997 and served until 2001. In 2001, Ronald J. Robinson was appointed Head and served until 2002. Hans Juvkam-Wold again served as Interim Head until 2004 when Stephen A. Holditch was named as Head. Dr. Holditch served as Head from 2004-2012. Dr. A. Daniel Hill served as Interim Head from January 2012 through January 2013. Dr. Hill took over as Head in January 2013.
Quality distinguishes our graduate program. We strive to improve the quality of students, research and instruction. High admission standards and thorough screening of applicants for advanced degrees help assure top-flight students. Our faculty members have substantial industrial experience and a record of high research productivity as measured by publications and grants. These attributes have prepared many of our graduates for the teaching profession and positions in industry. Texas A&M graduates almost 10% of the nation’s new petroleum engineers each year, and approximately 95% of those accept jobs in the petroleum industry.
Vision

Our graduates are our most important product. Our vision is

...that the statement "I am an Aggie Petroleum Engineer" is considered to be the most respected, prestigious self-definition within the global petroleum engineering profession.

Mission

We see our mission, then, as being able:

... to create, preserve, integrate, transfer and apply petroleum engineering knowledge
... to produce capable future engineers and to enhance the capabilities of current practitioners.
Successes

We are pleased to count the following among our successes:

- We have continued to foster our outstanding reputation in the global oil and gas community for turning out quality graduates and technical information;
- We had a positive review from ABET in 2010 for our undergraduate degree. The program will be reviewed again in 2016. ABET accreditation occurs every 6 years.
- We had a positive review of the PhD program in 2006 by an outside committee;
- We have strong enrollment at both the undergraduate and graduate levels with continued emphasis and improvements on the quality of our students;
- We have developed and are operating a model distance learning degree program for graduate degrees;
- Broadened research funding sources to include DOE, and over 50 companies.

Recommended Program Improvements

Since our Program Review in 2006, we have incorporated the following recommendations from the reviewers:

- Incorporated Ph.D. qualifying exams
- Increased level of research funding (approximately doubled)
- Increased enrollment in graduate program
- Large growth in distance learning program

Goals

We are working on the following projects to improve our ability to provide the best academic programs in petroleum engineering:

- We are improving our recruiting and admissions of graduate students to increase the quality of our graduate program. We are increasing the percentages of PhD students in our program to improve the quality of our research;
- We continue interviewing faculty candidates for new positions in College Station;
- We continue improving our computer capabilities by installing modern servers, participating in the cost of supercomputing, replacing classroom computers;
- We continue recruiting new member companies to the Crisman Institute, then working with these companies to generate industry-directed research projects; and
- We continue working with companies to assure there will be ample job offers for our graduates.
Strategic Plan

In 2011, the department developed a strategic plan for the period September 2011 to August 31, 2016. This plan was aligned with the College of Engineering strategic plan for those years, which included the following five overarching objectives:

**Objective 1: Experiential Learning**
*Infuse undergraduate curricula with experiential learning experiences in order to improve learning, help students connect their undergraduate experiences with future practice, and provide real-world contexts for concepts and approaches.*

**Objective 2: Re-Engineering the First-Year Engineering Program**
*Restructure the First-Year Engineering Program to improve preparation of students, increase retention, and improve the ability to make future curricular changes.*

**Objective 3: Graduate Program founded on World-Class Research**
*Ground the Graduate Program more firmly in a nationally and internationally recognized research environment.*

**Objective 4: World-Class Faculty Development**
*Enhance continuing professional development of world-class faculty, partly in order to consolidate institutional gains of Faculty Reinvestment.*

**Objective 5: K-14 Engagement**
*Enhance student diversity and quality and inspire student imagination through a more focused and intentional approach to K-14 engagement.*

In light of changes in College administration and in particular, the 25x25 initiative, it is time for a new strategic plan for the department.
## Faculty Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
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<tbody>
<tr>
<td>Barrufet, Maria</td>
<td>Professor</td>
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<tr>
<td>Blasingame, Tom</td>
<td>Professor</td>
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<td>Ehlig-Economides, Christine</td>
<td>Professor</td>
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<tr>
<td>Datta-Gupta, Akhil</td>
<td>Regents Professor</td>
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<td>Hasan, Rashid</td>
<td>Professor</td>
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<td>Hill, Dan</td>
<td>Professor</td>
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<td>Killough, John</td>
<td>Professor</td>
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<td>King, Mike</td>
<td>Professor</td>
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<td>Lane, Bob</td>
<td>Professor</td>
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<td>McVay, Duane</td>
<td>Professor</td>
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<tr>
<td>Nasr-El-Din, Hisham</td>
<td>Professor</td>
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<td>Valkó, Peter</td>
<td>Professor</td>
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<td>Wattenbarger, Bob</td>
<td>Professor</td>
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<td>Zhu, Ding</td>
<td>Professor</td>
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<tr>
<td>Reed, Teri</td>
<td>Associate Professor</td>
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<td>Schechter, David</td>
<td>Associate Professor</td>
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<td>Schubert, Jerome</td>
<td>Associate Professor</td>
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<tr>
<td>Akkutlu, Yucel</td>
<td>Associate Professor</td>
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<tr>
<td>Gildin, Eduardo</td>
<td>Assistant Professor</td>
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<tr>
<td>Hasçakir, Berna</td>
<td>Assistant Professor</td>
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<td>Heidari, Zoya</td>
<td>Assistant Professor</td>
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<td>Nasrabadi, Hadi</td>
<td>Assistant Professor</td>
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<tr>
<td>Noynaert, Sam</td>
<td>Assistant Professor</td>
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<tr>
<td>Dupriest, Fred</td>
<td>Professor of Engineering Practice</td>
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<tr>
<td>McLeroy, Priscilla</td>
<td>Professor of Engineering Practice</td>
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<td>Voneiff, George</td>
<td>Professor of Engineering Practice</td>
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<tr>
<td>Ayers, Walter</td>
<td>Visiting Professor</td>
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<td>McCain, Bill</td>
<td>Visiting Professor</td>
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<td>Moridis, George</td>
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<tr>
<td>Jochen, John</td>
<td>Senior Lecturer</td>
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<td>Maggard, Bryan</td>
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<td>Sliva, Cathy</td>
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<td>Sliva, Glenn</td>
<td>Senior Lecturer</td>
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<tr>
<td>Aschenbeck, Stacy</td>
<td>Communication Lecturer</td>
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<tr>
<td>Lin, Jiajing</td>
<td>Assistant Lecturer</td>
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<td>Bowman, Charles H.</td>
<td>Professor Emeritus</td>
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<td>Holditch, Steve</td>
<td>Professor Emeritus</td>
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<td>Jennings, James W.</td>
<td>Professor Emeritus</td>
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<td>Juvkam-Wold, Hans</td>
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<td>Lee, John</td>
<td>Regents Professor Emeritus</td>
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<td>Poston, Steven W.</td>
<td>Professor Emeritus</td>
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<td>Rollins, James T.</td>
<td>Professor Emeritus</td>
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<td>Startzman, Richard A.</td>
<td>Professor Emeritus</td>
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Faculty Committees

Departmental Committees
Awards Committee
Akhil Datta-Gupta – Chair
Zoya Heidari
John Killough
Jerome Schubert

Endowed Positions Committee
Maria Barrufet
Hisham Nasr-El-Din

Faculty Search and Hiring Committee
Maria Barrufet – Chair
Rashid Hasan
John Killough
Bob Lane
Sam Noynaert

Graduate Admissions Committee
Ding Zhu – Chair
Yucel Akkutlu
Maria Barrufet (DL)
Akhil Datta-Gupta
Eduardo Gildin
Zoya Heidari
Sam Noynaert

Graduate Student Fellowship Committee
Yucel Akkutlu - Chair
Maria Barrufet
Zoya Heidari
Dan Hill
Eleanor Schuler

Growth Committee
Maria Barrufet - Chair
Priscilla McLeroy
David Schechter

New Building Committee
Yucel Akkutlu
Jason Demshar
Hisham Nasr-El-Din
Frank Platt

Post-Tenure Review Committee
Mike King
Duane McVay
Peter Valko

Scholarship Committee
Bryan Maggard – Chair
Berna Hascakir
David Schechter
Carol Mumford

Tenure and Promotion Committee
Hisham Nasr-El-Din – Chair
Maria Barrufet
Tom Blasingame
Akhil Datta-Gupta
Mike King
Duane McVay
Bob Wattenbarger
Peter Valko
Ding Zhu
Yucel Akkutlu
Teri Reed
David Schechter
Jerome Schubert

Undergraduate Curriculum Committee
Peter Valko – Chair
Albertus Retnanto
John Killough
Bob Lane
Bryan Maggard
Priscilla McLeroy
Duane McVay
Teri Reed
David Schechter
Jerome Schubert
College / University Committees

College Honors and Awards Committee
   Peter Valko – Teaching/Service
   Hisham Nasr-El-Din - Research

College Design Lab Committee
   Duane McVay

College Endowed Position Selection Advisory Committee (College)
   Maria Barrufet

College Research Council
   Akhil Datta-Gupta
   Mike King (designee)

College T&P Committee
   Tom Blasingame

EFAC Representative (College)
   Jerome Schubert

Engineering Innovation Center (EIC) Faculty Committee (College)
   Duane McVay

Engineering Learning Technologies Advisory Council (ELTAC) (College)
   Maria Barrufet

External Awards Committee (College)
   Akhil Datta-Gupta

Evans Library Liaison (University)
   Peter Valko

Faculty-Staff Interaction Committee (University)
   Mike King

Graduate Advisors (GIC)
   Yucel Akkutlu

High Performance Computing (HPC) Committee (College)
   John Killough

New Student Conference Committee (College)
   Bryan Maggard
Non-Tenure Track Faculty Senate Committee (University)
   Priscilla McLeroy

Project Management Committee (College)
   Priscilla McLeroy

Tectonics/Basin Analysis Faculty Search Committee in G&G Department (College)
   Walt Ayers

Think Tank Committee (College)
   Akhil Datta-Gupta

University Disciplinary Appeals Panel
   Yucel Akkutlu
Petroleum Engineering Faculty Awards (National and International)

Yucel Akkutlu – Associate Professor
- SPE Distinguished Lecturer (2014)
- SPE “A Peer Apart” Status (2013)

Walter Ayers – Visiting Professor
- Distinguished Service Award, AAPG Energy Minerals Division (2008)
- Excellence in Presentation Award, AAPG/EMD (2000)
- Distinguished Alumni Professional Achievement Award, West Virginia University, Department of Geology and Geography (1995)

Maria Barrufet – Professor
- SPE Distinguished Member (2013)
- Russian Academy of National Sciences, United States Section – Golomb-Chilinger Medal of Honor (2008)

Thomas Blasingame – Professor
- SPE DeGolyer Distinguished Service Medal (2013)
- SPE Gulf Coast Regional Distinguished Achievement Award for Petroleum Engineering Faculty (2010)
- SPE Lester C. Uren Award (2006)
- SPE Distinguished Service Award (2005)
- SPE Distinguished Member

Charles Bowman – Professor Emeritus
- Honorary Director, American Petroleum Institute
- Distinguished Graduate, The Pennsylvania State University (1996)
- Triangle Fraternity Wall of Fame Member (1997)

Akhil Datta-Gupta – Regents Professor
- National Academy of Engineering (2012)
- SPE John Franklin Carll Award (2009)
- US DOE Award for Outstanding Contributions to Basic Research in Geosciences (2008)
- SPE Cedric K. Ferguson Award (2006)
- SPE Lester C. Uren Award (2003)
- SPE Distinguished Member (2001)
- SPE Cedric K. Ferguson Award (2000)
- SPE Distinguished Author (2000)
- SPE Distinguished Lecturer (1999-2000)
- AIME, Rossiter W. Raymond Award (1992)
Fred Dupriest – Professor of Engineering Practice
• SPE Drilling Engineering Award (2013)

Christine Ehlig-Economides – Professor
• SPE Anthony F. Lucas Gold Medal (2010)
• National Academy of Engineering (2003)
• SPE Distinguished Lecturer (1997-98)
• Lester C. Uren Award (1997)
• SPE Distinguished Member (1996)
• SPE Formation Evaluation Award (1995)
• SPE Distinguished Achievement Award for Petroleum Engineering Faculty (1982)

Zoya Heidari – Assistant Professor
• SPE Petroleum Engineer Junior Faculty Research Initiation Award (2012)

Dan Hill – Professor
• SPE Gulf Coast Regional Distinguished Achievement Award for Petroleum Engineering Faculty (2013)
• SPE Faculty Pipeline Award (2012)
• SPE Outstanding Technical Editor Award (2012)
• SPE Production and Operations Award (2008)
• SPE Distinguished Lecturer (1988-89)
• SPE Distinguished Member (1999)

Steve Holditch – Professor Emeritus
• SPE Honorary Member (2006)
• SPE/AIME Anthony F. Lucas Gold Medal (2005)
• ASME Rhodes Petroleum Industry Leadership Award (1999)
• SPE John Franklin Carll Award (1999)
• SPE Distinguished Lecturer (1997-98)
• Russian Academy of Natural Sciences (1997)
• National Academy of Engineering (1995)
• SPE Lester C. Uren Award (1994)
• SPE Distinguished Member (1989)
• SPE Distinguished Lecturer (1982-83)
• SPE Distinguished Service Award for Petroleum Engineering Faculty (1981)

Hans Juvkam-Wold – Professor Emeritus
• SPE Distinguished Member (2003)

John Killough - Professor
• SPE Reservoir Description and Dynamics Award (2013)
• National Science Foundation Research Fellow
• Alfred Noble Prize (1974)
• AIME Rossiter W. Raymond Award (1974)
Michael King – Professor
  • SPE Distinguished Member (2013)
  • SPE Reservoir Description and Dynamics Award (2011)
  • SPE Distinguished Lecturer (2006 – 2007)

Robert Lane - Professor
  • SPE Distinguished Member (2011)
  • SPE Distinguished Lecturer on Chemical Methods of Water Control (1999-2000)

John Lee – Regents Professor Emeritus
  • U.S. Securities and Exchange Commission (2009)
  • Russian Academy of Natural Sciences (2006)
  • AIME Mineral Industry Education Award (2002)
  • SPE Honorary Member (2001)
  • Texas Society of Professional Engineers “Dream Team” (2001)
  • AIME Honorary Member (2000)
  • SPE John Franklin Carll Award (1995)
  • Academy of Distinguished Engineering Alumni, Georgia Tech (1994)
  • National Academy of Engineering (1993)
  • SPE Distinguished Service Award (1992)
  • SPE Distinguished Member (1987)
  • SPE Regional Service Award (1987)
  • SPE Reservoir Engineering Award (1986)
  • Halliburton Education Foundation Award (1982-83)
  • SPE Distinguished Faculty Achievement Award (1982)
  • Distinguished Lecturer, SPE (1978)

William McCain – Visiting Professor
  • SPE Distinguished Membership (2005)

Duane McVay – Professor
  • SPE Outstanding Technical Editor Award (2012)
  • ConocoPhillips Faculty Sponsorship Award (2010)
  • SPE Distinguished Member (2007)
George Moridis – Visiting Professor
- US Department of Energy Secretary’s Honor Award (2011)
- SPE Distinguished Member (2010)
- SPE Distinguished Lecturer (2009-2010)
- Outstanding Reviewer Award, Editorial Board of Water Resources Research (2005, 2007)

Hisham Nasr-El-Din - Professor
- SPE Distinguished Achievement Award for Petroleum Engineering Faculty (2013)
- SPE “A Peer Apart” Status (2011)
- SPE Outstanding Associate Editor Award (SPEJ) (2009)
- SPE Production and Operations Award (2009)
- SPE Outstanding Associate Editor Award (SPEJ) (2008)
- SPE Outstanding Technical Editor Award (SPEPO) (2008)
- SPE Distinguished Member (2007)
- SPE Production and Operations Regional Award (2006)

Teri Reed – Associate Professor
- ASEE Sharon Keillor Award for Women in Engineering Education (2013)

Jerome Schubert – Associate Professor
- Texas Independent Producers and Royalty Owners Association - Texas Top Producers Award (2013)
- SPE Distinguished Member (2012)
- Hart’s Special Meritorious Engineering Award, Team Award (2002)

Richard Startzman – Professor Emeritus
- SPE Management and Information Award (2006)
- SPE Distinguished Member (1994)

Peter Valko – Professor
- Outstanding Associate Editor Award, SPE Journal (2008)

Bob Wattenbarger – Professor
- SPE Reservoir Description and Dynamics Award (2012)

Ding Zhu – Professor
- SPE Distinguished Lecturer (2011-2012)
- SPE Distinguished Member (2011)
- SPE Distinguished Achievement Award for Petroleum Engineering Faculty (2010)
Petroleum Engineering Staff Honors

Kathy Beladi – Senior Administrative Coordinator
• University Staff Council Executive Officer (2013-present)
• University Staff Council College Representative (2012-present)
• College of Engineering’s Dean Staff Achievement Award (2007)

Jason Demshar – Senior IT Manager
• Engineering Staff Advisory Council Member (2013-present)

Gail Krueger – Senior Administrative Coordinator
• Texas A&M University’s President’s Meritorious Service Award (2013)
• College of Engineering’s Dean Staff Achievement Award (2009)

Eleanor Schuler – Senior Administrative Coordinator
• College of Engineering’s Dean Staff Achievement Award (2008)
Faculty Workload Summary

Below are a series of charts indicating the current faculty work load per student in the College of Engineering including Petroleum Engineering (PETE)

*Total Students per Adjusted Tenure Track Faculty (ATTF) minus administrators*
Total Students per Tenure Track Faculty (TTF) plus Non-Tenured Track Faculty (NTTF)

Stu./(TTF+NTTF)
Undergraduate Students per ATTF

UG/ATTF

![Graph showing Undergraduate Students per ATTF over time for different subjects.](image-url)
Masters Students per ATTF (includes Distance Learning)
Ph.D. Students per ATTF

PhD/ATTF

[Graph showing data for various departments over years]
Graduate Program

This section of the academic review report summarizes the Petroleum Engineering graduate program administration and provides details on its operations. A summary of the graduate degrees currently offered are presented, followed by the admission process, financial support, and the graduate student enrollment. Finally, the demographics of the graduate student body and the peer rankings of the department are provided.

Office of the Graduate and Professional Studies

The Office of the Graduate and Professional Studies (OGAPS) is responsible for administering the graduate program for the University. Its responsibilities include:

- Administering the Graduate Faculty consisting of the President, the Provost, the Associate Provost, the Dean of OGAPS, the deans of all colleges, selected directors, and the academic group appointed by OGAPS;
- Granting formal admission into the graduate program;
- Preparing and issuing policies, rules and scheduling, governing the graduate program, and graduate merit and regents fellowships;
- Maintaining the graduate student academic record, i.e., proposed degree program, committee members, petitions, grades etc.;
- Reviewing the students’ records and determining whether they have complied with all the necessary degree requirements at each stage of their academic progress;
- Monitoring the student probationary status.

Graduate Degrees

Master of Science Degree

The degree requires a minimum of 32 semester credit hours of approved coursework beyond a Bachelor of Science degree, in addition to a thesis. The thesis must involve results of research conducted by the student and defended in an oral presentation in the presence of the student’s Graduate Advisory Committee.

Master of Science Degree (Non-thesis Option)

The degree requires a minimum of 36 credit hours of approved coursework beyond a Bachelor of Science degree, in addition to a technical report. Of these required hours, 18 credit hours must be in the major department. And a minimum of 6 credit hours must be in the other supporting fields. Additional courses are left to the discretion of the student’s Graduate Advisory Committee.

Master of Engineering Degree

The degree requires a minimum of 30 credit hours of approved coursework beyond a Bachelor of Science degree. It does not require a technical report but the work in the major field should include one or two written reports that do not necessarily involve results of research conducted by the student. Of these required hours, 18 credit hours must be in the major department. And a minimum of 6 credit hours must be in the other supporting fields. Additional courses are left to the discretion of the student’s Graduate Advisory Committee.
Doctor of Philosophy Degree
The Ph.D. degree requires a minimum of 96 credit hours of approved coursework beyond a Bachelor of Science degree, and a minimum of 64 credit hours for a student who has completed a master’s degree. A student in this program must pass the Qualifying Exam before the end of the student’s second semester of study (not including the summer semester) to continue.

Doctor of Engineering Degree
The College of Engineering offers the Doctor of Engineering degree with emphasis in various areas, including petroleum engineering. The degree requires a minimum of 64 credit hours for a student who has completed a master’s degree. It is not research oriented and developed to prepare the student to work at the highest levels of the engineering profession.

Doctor of Philosophy Degree in Interdisciplinary Engineering
Interdisciplinary Engineering Ph.D. degree is offered for those students whose research encompasses several engineering and science disciplines, including petroleum engineering. The degree was initiated to accommodate outstanding engineering students whose research interests cross engineering disciplines or colleges. A student applying to this program must be a current Ph.D. student in a department within the College of Engineering. The degree is administered under the leadership of the Associate Dean for Academic Affairs.

The department offers the Master of Science, Master of Engineering, and Doctor of Philosophy degrees in petroleum engineering. The majority of Master of Engineering degrees are awarded to distance learning (DL) students. The DL program in petroleum engineering was initiated in 1999 and today it is the most successful and fast-growing program in the College of Engineering. The Department of Petroleum Engineering does not offer the Master of Science degree non-thesis option.

Petroleum Engineering Graduate Programs Office
The Petroleum Engineering Graduate Programs Office is the departmental unit that administers the graduate program as outlined by the OGAPS. The office is located in the north side of the Richardson Building, Room 401W, and is open Monday through Friday from 8:00 A.M. to 5:00 P.M. The department of petroleum engineering faculty and staff are here to assist the students as they work toward their graduate degrees. The current Petroleum Engineering Department Graduate Advisor is Dr. Yucel Akkutlu. His office is located in RICH 401T and he may be reached at (979) 845-4069. Eleanor Schuler is the Graduate Programs Coordinator and Assistant to the Graduate Advisor. She may be reached at (979) 845-8402 or through the graduate office main number at (979) 845-2287.

The petroleum engineering Distance Learning Program Director is Dr. Maria Barrufet. Her office is located in RICH 407C and she may be reached at (979) 845-0314. Laura Ampol-Hall is the Program Coordinator and assistant to the Distance Learning Program Director. She may be reached at (979) 845-9385 or through the department main office at (979) 845-2241.

During the last 5 years, the department implemented changes to improve the quality of our graduate students and enhance our graduate program. We did this by (i) marketing the department through various conferences and graduate career fairs and recruiting high-quality undergraduate students, especially in the United States, and (ii) implementing a more structured graduate
admissions system. The departmental Graduate Admissions Committee has been developing the admission guidelines since 2005. We have also re-implemented the doctoral qualifying exam in a form that truly lets the graduate committee determine those qualified students who can perform independent research required for a Ph.D. degree.

Graduate Admissions
The admissions process is a joint process between the Office of Admissions and Records (OAR) and the Department of Petroleum Engineering. The application process is an on-line system coordinated with the Texas Common Application System and is available worldwide. A complete application consists of the filled application form with appropriate fee paid ($50 for domestic students, $90 for international students), official transcripts, official GRE test scores, TOEFL test scores for international students, statement of purpose, reference letters, and other documents which the applicant may provide to enhance the application.

All admission documents are collected by OAR and all paper documents are scanned into an electronic document repository called OARDOCS, which is accessible to Petroleum Engineering Graduate Programs Office by a secure internet browser connection. Once the application has been scanned in, the department creates their own file for each application received. The admissions decision for the department is processed through OARDOCS. The department can admit a student at any time in the admission process regardless of the completeness of the application file.

In addition to collecting official transcripts, OAR evaluates the transcripts by calculating the GPR on the last 60 hours of undergraduate coursework earned or if the student has a master’s degree, then the GPR is based on all graduate work taken, excluding non-degree courses. For international transcripts grades are converted to an equivalent 4.0 scale.

All applications received by the Department of Petroleum Engineering Graduate Programs Office are reviewed by the department’s Graduate Admissions Committee with the most qualified applicants being admitted and offered an assistantship with research or teaching from the department. The committee consists of several members of the Department of Petroleum Engineering Faculty, including the graduate advisor, and the director of the DL Program. The current committee includes three tenured professors, one tenured associate professor, three tenure-track assistant professors and one staff. One of the full professors chairs the committee.

Admission to the Petroleum Engineering Graduate program is highly competitive. Over the past seven years the admission criterion has been modified aiming at one goal – improving the quality of the graduate student body. All applicants are evaluated by their academic records and professional development. The admission is based on (in the order on importance) undergraduate program, (school and major), GPA of bachelor’s degree, GRE score, recommendation letters, statement essay, and professional activity and experience.

In the past several years, the number of applications has dramatically increased, averaging 500 – 600 each year. The quality of the applicants increased accordingly. We have emphasized on recruiting U.S. graduate students from recognized engineering programs, and encouraging women students to pursue graduate degrees, especially in the PhD program. The acceptance rate of application is about 15%.
The demographic of the student body has changed from over 90% international to a well-balanced program. The current students are from 55 countries with the highest population being from the U.S. (Table 1). The admitted students include engineering and science majored applicants from national highly ranked programs (MIT, Cornell, Brown University, UC-Berkeley, Cal-Tech, as examples) and impressive international programs (Tsinghua University, Indian School of Mines, Chulalongkorn University, as examples).

Table 1. Country Demographics

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<th>Country</th>
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<th>Master</th>
<th>DL_MEN</th>
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Table 2 shows in addition to more U.S. students, we have been able to recruit more students from top universities in the U.S. and throughout the world this academic year. We have competed for Fellowships at the University level, and have been awarded the Graduate Merit Fellowships and Diversity Fellowships (for outstanding minority applicants). At the College of Engineering level we also have received Top-Off Fellowships for outstanding applicants.

Table 2. 2013-14 New Students’ Academic Backgrounds

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<th>Country</th>
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<td><strong>44</strong></td>
<td><strong>122</strong></td>
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**Table 2. 2013-14 New Students’ Academic Backgrounds**

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As a result, the quality of the graduate student body has improved significantly. The average GPA of
admitted students is around 3.4 on a 4.0 scale, and the average GRE scores is 162 for the quantitative and 153 for verbal in the past 2 -3 years.

**Enrollment**
The department has one of the largest (if not the largest) petroleum engineering graduate student body in the country. Currently it has 415 graduate students in total. Out of this total number, 257 are the resident graduate students and 158 are DL students. The last several years this total number has been growing steadily and in parallel to the increase in the number of professors. We expect our graduate program to continue to grow steadily through increased demand for the DL Program and increased funding for research in the department budget.

The number of graduate students that can be properly supervised is indeed controlled by the size of the faculty and the number of post-doctorate fellows we can afford to hire, which, in turn, is controlled by the size of our research budget. Currently, about 27 professors are performing research. Each professor can supervise the research of about 5 to 8 graduate students on average. Thus, we can supervise in total only 135 to 215 resident students at any time. However, we have more than 50 new resident students who are mainly taking classes and not ready to start their thesis research, so they take relatively less time of the professors outside of the classroom teaching hours.

The number of students who have been admitted to the department is shown in Appendix B. The increase in enrollment is comparable to the other petroleum engineering schools in the country. As our research funding grows, we can increase the number of graduate students in our department by using post-doctorate fellows to help supervise some of the research. As the research faculty grows, we can add around 6 to 8 graduate students per new faculty member. Thus, it may be possible to increase the number of graduate students in the future if our research faculty and research funding continue to grow.

The Graduate Admissions Committee plays an important active role in maintaining a diverse graduate student body. The department currently has 87 female students. The distribution of the female students among the graduate programs in petroleum engineering is shown below. The complete list, including the student and supervisor names is given the Appendix C.

**Table 3. Distribution of Female Students in the graduate Student Body.**

<table>
<thead>
<tr>
<th>Total Graduate Students</th>
<th>Distance Learning</th>
<th>Masters</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>415</td>
<td>158</td>
<td>142</td>
<td>109</td>
</tr>
<tr>
<td>87 female</td>
<td>26 female</td>
<td>35 female</td>
<td>26 female</td>
</tr>
</tbody>
</table>

We have a growing and successful Master of Engineering (MEng) program delivered by the distance learning (DL). We currently offer around 12 to 14 courses per semester over the internet. The MEng degree by DL requires a minimum of 36 hours - or about 12 courses - and a technical report which the student must submit in writing and present orally.

Most DL students take around 1 to 3 courses per year because they simultaneously hold full-time engineering positions in the industry. The entire course content is delivered over the internet, so
anyone can be a DL student regardless of their location globally. All DL students must be accepted for admission to the graduate school at Texas A&M University as would any of our on-campus students.

We can also offer courses required for the Master of Science (MS) and Doctor of Philosophy (Ph.D.) degrees by DL. However, MS or PhD candidate must satisfy the university residency requirements and must maintain close contact with the supervisory committee during the thesis or dissertation research.
Table 4. Recent Graduate Enrollment

<table>
<thead>
<tr>
<th>Year</th>
<th>Master</th>
<th>PhD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2007</td>
<td>111</td>
<td>50</td>
<td>161</td>
</tr>
<tr>
<td>2007-2008</td>
<td>114</td>
<td>64</td>
<td>178</td>
</tr>
<tr>
<td>2008-2009</td>
<td>117</td>
<td>77</td>
<td>194</td>
</tr>
<tr>
<td>2009-2010</td>
<td>144</td>
<td>80</td>
<td>224</td>
</tr>
<tr>
<td>2010-2011</td>
<td>137</td>
<td>103</td>
<td>240</td>
</tr>
<tr>
<td>2011-2012</td>
<td>152</td>
<td>104</td>
<td>256</td>
</tr>
<tr>
<td>2012-2013</td>
<td>153</td>
<td>103</td>
<td>256</td>
</tr>
</tbody>
</table>
Table 5. Recent Graduate Degrees

<table>
<thead>
<tr>
<th>Year</th>
<th>Master</th>
<th>PhD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2007</td>
<td>48</td>
<td>5</td>
<td>53</td>
</tr>
<tr>
<td>2007-2008</td>
<td>50</td>
<td>12</td>
<td>62</td>
</tr>
<tr>
<td>2008-2009</td>
<td>50</td>
<td>18</td>
<td>68</td>
</tr>
<tr>
<td>2009-2010</td>
<td>71</td>
<td>5</td>
<td>76</td>
</tr>
<tr>
<td>2010-2011</td>
<td>72</td>
<td>17</td>
<td>89</td>
</tr>
<tr>
<td>2011-2012</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>2012-2013</td>
<td>76</td>
<td>26</td>
<td>102</td>
</tr>
<tr>
<td>Total</td>
<td>447</td>
<td>103</td>
<td>550</td>
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</table>

Table 6. Enrollment History in DL Master of Engineering Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2007</td>
<td>56</td>
</tr>
<tr>
<td>2007-2008</td>
<td>70</td>
</tr>
<tr>
<td>2008-2009</td>
<td>81</td>
</tr>
<tr>
<td>2009-2010</td>
<td>92</td>
</tr>
<tr>
<td>2010-2011</td>
<td>101</td>
</tr>
<tr>
<td>2011-2002</td>
<td>113</td>
</tr>
<tr>
<td>2012-2013</td>
<td>131</td>
</tr>
</tbody>
</table>

Financial Assistance

There are several mechanisms of support for the Texas A&M University graduate students. The petroleum engineering graduate students are offered financial assistance through fellowships, research assistantships, teaching assistantships, and student technicians. We also have students that are sponsored. Fellowships are offered to the most qualified incoming new students for their first year to allow them time to find a research project to work on or other position within the department.

Fellowships (varies)
- $1,000 – $30,000

Graduate Research Assistantships (GAR)
- $1,700 for MS
- $1,700 for PhD
- $1,850 for PhD once they pass the PhD qualifying exam

Graduate Teaching Assistantships (GAT)
- $1,700 for MS
- $1,700 for PhD
- $1,850 for PhD once they pass the PhD qualifying exam
Degree Requirements

We currently have around 142 Master of Science, 6 Master of Engineering and 109 Ph.D. students on campus. We have 158 students taking graduate courses by distance learning. A list of the Ph.D. graduated students and their completed research topics since 2006 is presented in Appendix D.

We have very few but strict rules concerning the course work that students have to take to get a Master or a Doctoral degree. Essentially the student’s committee chairman and the graduate committee establish what should be included on the degree plan on the basis of the student’s background and current research interest. The degree plan should be prepared such that the student is best equipped to perform the research and complete the degree successfully. The university, on the other hand, does have a few rules, which are included below.

Master of Science

- Include a minimum of 32 credit hours in the degree plan. (The committee can require more.)
  - Complete at least 9 credit hours on campus during one semester to establish residency.
  - Take approximately 1/3 of the courses (2-3 courses) outside the department.

- Observe the University limits on certain courses:
  - No more than 12 hours transfer credit from another university.
  - No more than 12 hours of 689 courses.
  - No more than 8 hours of 691 and/or 685 courses.
  - No credit for 684 courses.
  - No more than 2 hours of 681 courses.
  - No more than 9 hours of undergraduate courses.

- Select the chairman of the committee before the start of the second semester.
  - Agree on at least 3 committee members, with 1 outside the department.
  - File a degree plan before the beginning of the second semester but by no means later than 90 days before your final oral examination.

- The student must have an average GPR of 3.0 for all courses on the degree plan before the student can take the final exam.

- The student must submit the thesis proposal to the OGS at least 14 weeks before the close of the semester in which the student expect to receive the degree or before the student schedule the final examination, whichever occurs first.

- Complete the Thesis and final examination.

- Complete all requirements within 7 years.

Master of Engineering – On Campus

- Include a minimum of 30 credit hours in the degree plan. (The committee can require more.)
  - Take approximately 1/3 of the courses (2-3 courses) outside the department.
  - Take 3 hours of PETE 692 for credit for the engineering project

- Observe the University limits on certain courses:
  - No more than 12 hours transfer credit from another university.
• No more than 12 hours of 689 courses.
• No more than 4 hours of 684 or 685 courses.
• No credit for 691 courses.
• No more than 2 hours of 681 courses.
• No more than 9 hours of undergraduate courses.

• Select the chairman of the committee before the start of the second semester.
  • Agree on at least 3 committee members, with 1 outside the department.
  • File a degree plan before the beginning of the second semester but by no means later than 90 days before the final oral examination.

• The student must have an average GPR of 3.0 for all courses on the degree plan before the student can take the final exam.

• Write one or two major reports involving Petroleum Engineering subject matter and complete the final exam.

• Complete all requirements within 7 years.

**Master of Engineering – Distance Learning**

• Include a minimum of 36 credit hours in the degree plan. (The committee can require more.)
  • Take at least 3 of the core courses listed below.
  • Take 3 hours of PETE 692 for credit for the engineering project

• Observe University limits on certain courses:
  • No more than 12 hours transfer credit from another university.
  • No more than 12 hours of 689 courses.
  • No more than 4 hours of 684 or 685 courses.
  • No credit for 691 courses.
  • No more than 2 hours of 681 courses.
  • No more than 9 hours of undergraduate courses.

• Select the chairman of the committee before the start of the second semester.
  • Agree on at least 3 committee members, with 1 outside the department.
  • File a degree plan before the beginning of the second semester but by no means later than 90 days before the final oral examination.

• The student must have an average GPR of 3.0 for all courses on the degree plan before the student can take the final exam.

• Write one or two major reports involving Petroleum Engineering subject matter and complete the final exam.

• Complete all requirements within 7 years.

**Additional Master’s programs**

**Institut Francais du Pétrole (IFP) Joint Degree Program**

Other Master degrees that are offered by the Petroleum Engineering department include joint degree programs with Institut Francais du Pétrole (IFP) leading to the Master of Engineering degree. Admission to the joint degree program requires that the student be admitted (independently) by both IFP and Texas A&M University. The program consists of the first Fall semester at TAMU, then Spring and Summer semesters at IFP and then the next and last Fall semester at TAMU. This program is rigid in its coursework components and includes a research thesis (and one additional semester) if a student elects to pursue Master of Science degree. **Appendix E**
International Petroleum Management Certificate (IPM)
As part of this Master of Engineering program, the Lowry Mays College and Graduate School of Business will award a degree candidate a Certificate in International Petroleum Management. To qualify for this certificate the student must complete at least 18 semester hours of coursework in the Lowry Mays College and Graduate School of Business. Most MEN students complete 18 hours of petroleum engineering coursework and 18 hours of business coursework. This option is available for MS and Ph.D. students who include a minimum of 18 hours of business coursework on their degree plans in addition to their required degree work. Appendix F

Fast Track
Recently the department has initiated a fast track degree program allowing qualified undergraduate petroleum engineering students to pursue graduate degree in petroleum engineering. This allows the undergraduate students to begin graduate studies at the end of their junior year and to complete both their B.S. and MS or MEng degrees within five years. The requirements:

- The student must finish junior year with a cumulative GPA of 3.5 or above;
- The student needs to be approved by the Undergraduate Advisor;
- The student begin taking approved graduate courses only during the senior year;
- Maximum of two graduate courses are allowed per semester during the senior year;
- The students need to take GRE during or before the winter break of the senior year;
- The Graduate Admissions Committee shall review the application for admission to the graduate program.

This year the department has recruited the first group of fast track consisting of seven students. Further fast track information can be found in Appendix G

Doctor of Philosophy
- Include a minimum of 64 credit hours beyond the MS degree or 96 hours beyond the BS degree in the degree plan. Doctoral student who do not have a PETE background are encourage to take at least 3 of the 5 core courses.
  - Complete at least 1 academic year on campus to establish residency, if the student holds the MS degree or 2 academic years if the student holds only BS degree.
  - Take the PhD Qualifying Examination after one year of entering the program.
  - The graduate committee is in charge of the courses that will be on the degree plan. In general, the student should take 2/3 course work and, 1/3 research/seminar courses.
  - Approximately 1/3 of the course work (4-6 courses) should be outside of the department.
  - During the semester when the students write the research proposal, the student should sign up for the 685 technical writing courses, if the student has not already taken the course.
- Select the chairman of the committee before the start of the second semester.
  - Agree on at least 4 committee members, with 1 outside the department.
  - File a degree plan before the beginning of the third semester but by no means later than 90 days before the final oral examination.
- Take the preliminary examination when student has passed all but the last 6 credit hours of formal course work (except for 681 and 691 courses) on the degree plan, or no later than the end of the semester when the student complete the formal course work.
Submit the results of the preliminary examination to the Office of Graduate Studies at least 14 weeks before the final examination date.

- The preliminary exam should be both oral and written.
- Each member of the advisory committee is responsible for administering a written examination in his or her particular field, unless the member chooses to waive participation in this part of the examination.

- The student must have an average GPR of 3.0 for all courses on the degree plan before the student can take the final exam.
- Submit the dissertation proposal to the Office of Graduate Studies at least 14 weeks before the student schedules the final examination.
- Complete the dissertation and final exam.
- Complete all requirements within 10 years

**Doctoral Examinations and Degree Completion Requirements in Petroleum Engineering**

**Qualifying Examination**

The purpose of the Ph.D. Qualifying Examination (QE) is to ensure that all Petroleum Engineering doctoral students advancing to candidacy have required background in three primary areas: drilling, production and reservoir engineering. In essence, QE serves as a quality-control instrument.

The Ph.D. qualifying examination is offered once a year, normally in the beginning of the Fall semester, during the third week of September. All doctoral students completing their first year in the department are required to take the qualifying examination.

The Ph.D. qualifying examination consists of three written exams, each in the areas of Reservoir Engineering, Production Engineering, and Drilling Engineering. The material covered in the qualifying examination is from the following books:

- **Drilling Engineering**: Applied Drilling Engineering, by Bourgoyne, Chenevert, Millheim, and Young

A registration number is given to each candidate, which he/she will write on the examination paper. The student is not allowed to write his/her name or the university ID number on the examination paper. All examinations are OPEN BOOK. Each of the three written examinations lasts two hours. Students must pass all three examinations to be qualified for Ph.D. A student scoring 70% or more passes the examination in that area of specialization. A student scoring 60-70% is given a ‘conditional pass’. A student scoring less than 60% is asked to repeat the examination in the subject area when it is offered next time.

A two member committee sets each examination and also evaluates the examination papers. The chair of the committee in each subject area is also the member of the graduate admissions committee. He/she selects another faculty member in the subject area to form the two member committee. When the
upcoming QE is announced to the petroleum engineering graduate students and faculty, the faculty is encouraged to submit problems to the committee along with their solutions for any of the written exams.

**Conditional Pass:**
A student receiving a conditional pass must take a remedial course in the subject area, although that course will not be counted towards the student’s degree plan. The student should receive a grade of B or above from the remedial course for successful completion. Upon successful completion, the student will be issued a pass for that subject area of the qualifying exam. A grade of C or below will be considered a failure for the exam and the student will be dismissed from the doctoral program.

**Failure:**
A student failing the qualifying examination is allowed a second and final attempt in the following academic year. A student then retakes only the examination in the subject area(s) that he/she failed in the previous year. If the student fails on the second attempt, the student will be dismissed from the PhD program. A student must pass ALL three written examinations. If a student fails any of the three examinations twice then the student has failed the QE and will be dismissed from the doctoral program.

Ph.D. students are encouraged to take PETE 661 (Drilling Engineering), PETE 662 (Production Engineering), and PETE 665 (Reservoir Engineering), or the equivalent graduate courses, as part of their first year study to prepare for the QE (Appendix H).

**Preliminary Examination**
Each student is required to take a preliminary examination. The purpose of the preliminary examination is for the student’s committee to determine whether the student has demonstrated a mastery of the subject matter of all fields related to the dissertation and an adequate knowledge of the literature in these fields, and an ability to carry out bibliographical research.

This exam is given no earlier than a date at which the student is within approximately 6 credit hours of completing the formal coursework on the degree plan and no later than the end of the semester following the completion of this formal coursework on the degree plan. The examination is both oral and written. The written part covers the topic of the student’s planned dissertation and serves as a proposal for the same. The oral component provides a presentation of the proposed material.

If the student fails the examination, with the approval of the Advisory Committee and of the OGS, the student is given adequate time for a re-examination. Typically a six months period is given.

**Research Proposal**
The general field of research to be used for the dissertation should be agreed on by the student and the advisory committee at their first meeting, as a basis for selecting the proper courses to support the proposed research. As soon thereafter as the research project can be outlined in reasonable detail, the dissertation research proposal should be completed. The research proposal should be approved at a meeting of the student’s advisory committee, at which time the feasibility of the proposed research and the adequacy of available facilities should be reviewed. The approved proposal, signed by all members of the student’s advisory committee, the head of the student’s major department (or chair of the intercollegiate faculty, if applicable), must be submitted to the Office of Graduate and Professional Studies at least 15 working days prior to the submission of the Request for the Final Examination.
Compliance issues must be addressed if a graduate student is performing research involving human subjects, animals, infectious biohazards and recombinant DNA. A student involved in these types of research should check with the Office of Research Compliance and Biosafety at (979) 458-1467 to address questions about all research compliance responsibilities. Additional information can also be obtained on the website rcb.tamu.edu.

Admission to Candidacy
To be admitted to candidacy for a doctoral degree, a student must have: (1) completed all formal coursework on the degree plan with the exception of any remaining 681, 684, 690 and 691, (2) a 3.0 Graduate GPA and a Degree Plan GPA of at least 3.0 with no grade lower than C in any course on the degree plan, (3) passed the preliminary examination (written and oral portions), (4) submitted an approved dissertation proposal, (5) met the residence requirements. The final examination will not be authorized for any doctoral student who has not been admitted to candidacy.

Final Defense
The candidate for the doctoral degree must pass a final examination by the deadlines announced in the OGS calendar each semester, including the summer session. A student must have completed all coursework on the degree plan with the exception of the remaining PETE 691 (research) for which the student is registered.

The student’s Advisory Committee conducts the final examination, or the defense. The dissertation must be available in substantially final form to the Advisory Committee, and the Committee must be given adequate time to review the document. Although the final examination may cover the broad field of the doctoral candidate’s training, the major portion of the examination time is devoted to the dissertation and the allied topics. A positive vote by all members of the graduate committee, with at most one dissention, is required to pass a student on the examination.

Graduate Courses
The department offers a wide variety of courses for graduate students. The courses include fundamental subjects in four areas of specialization: drilling, production, reservoir, formation evaluation and economics.

The department offers 12 graduate core courses throughout an academic year. Master’s degree students are encouraged to include at least three (3) of these core courses in their degree plan:

For Entering MS Students with a BS in Petroleum Engineering
- PETE 603 Advanced Reservoir Engineering I
- PETE 605 Phase Behavior of Petroleum Reservoir Fluids
- PETE 608 Well Logging Methods
- PETE 618 Modern Petroleum Production
- PETE 620 Fluid Flow in Petroleum Reservoirs
- PETE 625 Well Control (or PETE 626 Offshore Drilling)
- PETE 664 Petroleum Project Evaluation and Management
For Entering MS Students without a BS in Petroleum Engineering

- PETE 661 Drilling Engineering
- PETE 662 Production Engineering
- PETE 663 Formation Evaluation and Analysis of Reservoir Performance
- PETE 664 Petroleum Project Evaluation and Management
- PETE 665 Petroleum Reservoir Engineering

In addition, our professors have developed courses to teach in advanced topics in their specialties. Most of our faculty members are involved with teaching graduate courses. Our introductory courses have been taught for many years by various professors. Appendix I contains a list of all of the courses we offer; the list changes on the basis of who is on our faculty and the type of research projects our faculty is working on at the time; and not all courses are taught every year. The syllabi of all the graduate courses are also included in Appendix I. The graduate courses offered and enrollments in 2012 and 2013 are shown below.

**Table 7. Graduate Course Offerings 2012**

### SPRING 2012

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Instructor</th>
<th>On Campus</th>
<th>DL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PETE 605</td>
<td>PHASE BEH OF PET RES F</td>
<td>McCain</td>
<td>7</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>PETE 611</td>
<td>APP PETE RESERVOIR SIM</td>
<td>McVay</td>
<td>20</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>PETE 613</td>
<td>NATURAL GAS ENGINEERING</td>
<td>Wattenbarger</td>
<td>19</td>
<td>0</td>
<td>19</td>
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<tr>
<td>PETE 618</td>
<td>MODERN PETRO PRODUCTION</td>
<td>Zhu/Hasan</td>
<td>25</td>
<td>17</td>
<td>42</td>
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<tr>
<td>PETE 625</td>
<td>WELL CONTROL</td>
<td>Schubert</td>
<td>14</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>PETE 629</td>
<td>ADV HYDRAULIC FRACTURING</td>
<td>Valko</td>
<td>33</td>
<td>4</td>
<td>37</td>
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<tr>
<td>PETE 630</td>
<td>GEOSTATISTICS</td>
<td>Datta-Gupta</td>
<td>20</td>
<td>0</td>
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</tr>
<tr>
<td>PETE 631</td>
<td>PETR RESERVOIR DESCRIPT</td>
<td>Blasingame</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>PETE 642</td>
<td>FORM DAMAGE MECH &amp; REMED</td>
<td>Nasreldin</td>
<td>20</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>PETE 644</td>
<td>CO2 CAPTURE &amp; USES</td>
<td>Barrufet</td>
<td>8</td>
<td>14</td>
<td>22</td>
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<tr>
<td>PETE 650</td>
<td>ADVANCED DRILLING ENGR</td>
<td>Teodoroi</td>
<td>5</td>
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<td>15</td>
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<tr>
<td>PETE 661</td>
<td>DRILLING ENGINEERING</td>
<td>Schubert</td>
<td>29</td>
<td>25</td>
<td>54</td>
</tr>
<tr>
<td>PETE 667</td>
<td>RESERVES AND EVALUATION</td>
<td>Voneiff</td>
<td>13</td>
<td>15</td>
<td>28</td>
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<tr>
<td>PETE 681</td>
<td>SEMINAR</td>
<td>Gildin/Heidari</td>
<td>142</td>
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<td>142</td>
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<tr>
<td>PETE 689</td>
<td>SPTP:ADV NUM METH RES SIM</td>
<td>Gildin</td>
<td>37</td>
<td>2</td>
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</table>

### SUMMER 2012

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<td>Maggard</td>
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<tr>
<td>PETE 621</td>
<td>PETROLEUM DEV STRATEGY</td>
<td>Nordt</td>
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<td>PETE 640</td>
<td>MOD SIMUL TRANSP MEDIA</td>
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<td>0</td>
<td>7</td>
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<tr>
<td>PETE 648</td>
<td>PRESS TRANSIENT TEST</td>
<td>Economides</td>
<td>22</td>
<td>6</td>
<td>28</td>
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<tr>
<td>PETE 661</td>
<td>DRILLING ENGINEERING</td>
<td>Schubert</td>
<td>20</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>PETE 663</td>
<td>FORM EVAL ANLY RESR PERF</td>
<td>Schechter</td>
<td>8</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>PETE 665</td>
<td>PETE RESERVOIR ENGR</td>
<td>McCain</td>
<td>11</td>
<td>12</td>
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</table>
## FALL 2012

<table>
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<th>DL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PETE 602</td>
<td>WELL STIMULATION</td>
<td>Nasreldin</td>
<td>33</td>
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## Table 8. Graduate Course Offerings 2013

### SPRING 2013

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44
SUMMER 2013

PETE 611  APP PETE RESERVOIR SIM  Maggard  14  12  26
PETE 640  MOD SIMUL TRANSP MEDIA  Moridis  9  0  9
PETE 661  DRILLING ENGINEERING  Schubert  25  23  48
PETE 663  FORM EVAL ANLY RESR PERF  Schechter  10  32  42
PETE 665  PETE RESERVOIR ENGR  McCain  4  18  22

Fall 2013

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Graduate Seminar Series

Once per week during the academic year, the department holds a 1-hour seminar. This seminar is listed in the graduate catalog as course PETE 681. The speakers are invited and come from outside of the university and they represent established researchers in their disciplines, including researchers from academia, government, laboratories, and industry. (Appendix J)
Graduated Students Holding Academic Positions

The Petroleum Engineering program at Texas A&M University is widely recognized for its academic qualities not only by the industry but also the academia. This often leads to our graduates being hired for faculty positions globally. Appendix K includes a list of our graduate students currently holding faculty positions.

Support Staff

Day-to-day operations of the department depend heavily on the assistance of our highly qualified support staff. We currently have 19 full-time staff working for the department, 3 postdoc researchers, and 3 working for the Global Petroleum Research Institute (GPRI), in addition to a number of student workers who serve as part of the staff. Those workers are not included in the numbers listed above. The department’s staff is organized as follows:

Financial
• Rudy Schultz – Business Administrator II
• Tim Meekma – Business Coordinator III
• John Winkler – Business Coordinator III

Administrative
• Kathy Beladi – Senior Administrative Coordinator
• Jessica Chandos – Program Assistant
• Phaedra Hopcus – Senior Program Specialist
• Nancy Luedke – Communications Coordinator
• Betty Robbins – Administrative Coordinator

Facilities
• John Maldonado – Facilities Manager
• Don Conlee – Senior Research Technician

IT/Computer Support
• Jason Demshar – Senior IT Manager
• Stuart White – IT Professional I

Graduate Administration
• Eleanor Schuler – Senior Administrative Coordinator
• Barbi Miller – Lead Office Assistant

Undergraduate Administration
• Gail Krueger – Senior Administrative Coordinator
• Carol Mumford – Program Coordinator

Distance Learning
• Laura Hall – Program Coordinator
• Mary Lu Epps – Senior Information Specialist II
• Ted Seidel – Senior Information Specialist II
The size of the staff is currently sufficient for the size of the faculty and the department. We have to deal with an incredible bureaucracy at Texas A&M University that includes University administration, the Texas Engineering Experiment Station (TEES), and the Texas A&M Development foundation. All three groups have their own procedures, their own accounting systems, their own rules for charging expenses, and their own way of entering and retrieving data. It is an understatement to say the workload on the staff is exaggerated by having to deal with three separate bureaucracies.
Research Facilities

Acid Fracture Research Laboratory (808) - Dr. Dan Hill/Dr. Ding Zhu
The Acid Fracture Research Lab is designed to study acid fracture conductivity behavior as functions of important parameters. Each experiment has 4 major steps; rock sample preparation, cell preparation and loading, acid injection, and fracture conductivity measurement. The set-up consists an acid injection apparatus, a fracture conductivity measurement apparatus, and a profilometer for surface scanning.

The acid injection uses a modified API conductivity cell that holds the samples in place during the experiments. The cell is corrosion resistant and can withstand pressures that over 10,000 psi. This injection system is designed to flow acid through the API cell at high pressures (greater than 1000 psi). The pressure transducers display the pressure inside the cell, across the fracture, and the leak-off pressure (across the samples). The Chem-Pump is a metered pump that is able to flow up to a rate of 1.05 liters/minutes. Thermocouples located upstream and downstream of the cell provide temperature data during the injection. Backpressure regulators ensure that the system stays at the desired pressure of 1000 psi.

The apparatus used to measure fracture conductivity is designed to flow a fluid through the API cell that is subject to varying closure stresses. A load frame holds the cell in a horizontal position. Pressure transducers measure the pressure across the fracture and in the cell. Three pressure transducers measure different ranges of pressure drop. A thermocouple located downstream of the cell provides temperature data. The flow rate of the fluid flowing through the cell is measured using a stopwatch and a graduated cylinder.

The surface of the rock samples can be scanned with a profilometer before and after acid injection to determine the volume of rock removed during the acid injection. The apparatus includes a laser sensor, control box, and PC software interface. The profilometer uses the laser displacement sensor to record the vertical height of the sample as it travels over the entire length and width of the sample.

Advanced Instruments Lab (512) - Dr. Hisham Nasr-El-Din
The Advanced Instruments Lab contains equipment used in the detection, classification, analysis, and imaging of rock samples, sediments, and fluids. Descriptions of each piece of equipment are listed below.
• S2 Ranger X-Ray Fluorescence (XRF) - An x-ray instrument used for routine, relatively non-destructive chemical analyses of rocks, minerals, sediments and fluids.
• Optima 7000 DV Inductively Coupled Plasma (ICP) - A type of mass spectrometry which is capable of detecting metals and several non-metals at concentrations as low as one part in 1012 (part per trillion).
• Evex Mini- Scanning Electron Microscope (SEM) - A type of electron microscope that produces images of a sample by scanning it with a focused beam of electrons.
• XDS 2000 X-Ray Diffraction (XRD) - Used for determining the atomic and molecular structure of a crystal, in which the crystalline atoms cause a beam of X-rays to diffract into many specific directions.
• MSC-1000 Mini-Sputter Coater - Used to coat the gold to the samples for SEM.
**Anadarko Petrophysics Laboratory (212) - Dr. Hisham Nasr-El-Din**

This lab focuses on the petrophysical techniques listed below.

- Distillation - Either of two extraction methods (Dean-Stark) or Retort Distillation can be used to determine the fluid saturation inside the cores.
- Coreflood setup - Used to determine the initial permeability of the core samples using one fluid. It can also be used to determine the relative permeability to oil and water when both fluids are injected simultaneously.
- Centrifuge - Used to determine the capillary pressure data for a core.
- Profile Parameter
- Sonic sifters - Used to determine the particle size distribution and sieve analysis.
- Oil bath - Used to determine the viscosity of liquids at higher temperatures.
- Acoustic velocity - Used to determine the wave velocities on rock samples as a function of confining stress and pore pressure comprising an ultrasonic transducer assembly, pressure vessel (Core Holder) and pore pressure intensifier. The pore pressure intensifier part is not currently available in the unit in lab 212. Rock properties such as shear modulus, Poisson’s ratio, bulk modulus, and Young’s modulus can be calculated from the wave velocities.
- Helium porosimeter - Used to determine the porosity for core samples using simple Boyle’s law.
- Tensiometer - Used to determine the surface and interfacial tension for liquids using Wilhelmy plate method.

**BP Laboratory for Field Studies (313) - Dr. Maria Barrufet**

This teaching laboratory provides a state-of-the-art technology and computer resource for advanced, team-based reservoir engineering courses. The lab will provide students with GeoGraphix software, reservoir simulation software by Computer Modelling Group Ltd. (CMG), 40 computer workstations, and three SMART boards.

**Chevron Drilling and Completions Laboratory (216) - Dr. Jerome Schubert**

This teaching lab has a drilling cementing and stimulation measurement equipment as well as a drilling rig simulator and software. The lab simulates a realistic rig floor using a drilling simulator and they hydraulic tubing tongs currently used for research and other equipment typically found on a rig floor. The hands-on approach will help student learn the importance of drilling mud properties and how changes can help identify and solve potential drilling programs.

**Chevron Petrophysical Imaging Laboratory (823) - Dr. David Schechter**

The Chevron Petrophysical Imaging Laboratory has a state of the art Toshiba Aquilion RXL CT Scanner with 3D advanced visualization software. Its 16-detector row 32 slice computerized tomography system delivers high speed iterative image reconstruction of 0.5 mm data sets at up to 16 images per second. The scanner has a 72 cm gantry opening with +/- 30 degrees tilt with an accurate 0.5 mm x 16-row high-resolution detector. Also, the CT Scanner has an industry leading low contrast resolution of 2mm @ 0.3%. The Toshiba Aquilion RXL CT Scanner is a high-precision instrument that can measure the porosity, fluid density and changes in saturation in cores samples and enhanced oil recovery flood experiments such as water, gas or CO₂ flooding. Also, it can be used to visualize natural fractures in cores samples and wormhole propagation in cores exposed to acid treatments.
**CO2 EOR Laboratory (803) - Dr. David Schechter**
Research projects in this lab include CO2 EOR in Unconventional Liquid Reservoirs and CO2 Injection in the North Burbank Unit.

**Evaluation of Oilfield Chemicals Laboratory (822) - Dr. Hisham Nasr-El-Din**
Extensive testing is performed on oilfield chemicals before and after being selected for use in production operations. Some tests include zeta potential to test clay stabilizers or general surface charges and HPLC to determine the molecular weight distribution of polymers.

Atomic absorption spectroscopy (AAS) is a spectro-analytical procedure for the quantitative determination of chemical elements employing the absorption of optical radiation (light) by free atoms in the gaseous state. In analytical chemistry the technique is used for determining the concentration of a particular element (the analyte) in a sample to be analyzed.

Gas chromatography (GC) is a common type of chromatography used in analytical chemistry for separating and analyzing compounds that can be vaporized without decomposition. Typical uses of GC include testing the purity of a particular substance, or separating the different components of a mixture (the relative amounts of such components can also be determined). In some situations, GC may help in identifying a compound. In preparative chromatography, GC can be used to prepare pure compounds from a mixture.

High-performance liquid chromatography (HPLC) is a chromatographic technique used to separate the components in a mixture, to identify each component, and to quantify each component. It relies on pumps to pass a pressurized liquid and a sample mixture through a column filled with a sorbent, leading to the separation of the sample components.

Zeta potential is a scientific term for electro kinetic potential in colloidal systems. The significance of zeta potential is that its value can be related to the stability of colloidal dispersions (e.g., multivitamin syrup). The zeta potential indicates the degree of repulsion between adjacent, similarly charged particles (the vitamins) in dispersion. For molecules and particles that are small enough, a high zeta potential will confer stability, i.e., the solution or dispersion will resist aggregation. When the potential is low, attraction exceeds repulsion and the dispersion will break and flocculate. So, colloids with high zeta potential (negative or positive) are electrically stabilized while colloids with low zeta potentials tend to coagulate.

**Formation Damage Studies (814) - Dr. Hisham Nasr-El-Din**
The Formation Damage Studies Lab studies the rheology properties of drilling fluids, the formation damage caused by drilling fluids, and the observations of fluid samples under heat and pressure.
Equipment listed below:
- OFITE HP/HT Filter Press - Designed for testing drilling fluids and cement under elevated temperatures and pressures. The unit simulates various downhole conditions and provides a reliable method for determining the effectiveness of the material being tested.
- HP/HT Visual Reactor - Used for visual observations of reactions and other purposes.
- Grace Instrument M3600 Viscometer - Engineered to do laboratory researches for advanced rheology testing. It is need to be used with a Microsoft Windows PC and the included M3600DAQ™ and M3600Frac™ software.
• OFITE Five-Spindle, Single-Speed Multi-Mixer - Used in general purpose mixing of drilling fluids in preparation for laboratory tests of mud materials.

• Laboratory Oven

Gas Hydrates Laboratory (721) – Dr. Yucel Akkutlu
Sophisticated high-pressure and low-temperature equipment is devoted to the understanding of the growth and dissolution of gas hydrate crystals in PVT cell and in porous media. Gas hydrates and fluids modeling under various subsurface conditions using thermodynamic equilibrium and non-equilibrium molecular simulations.

HP/HT Fluid Property Measurement Laboratory (1001C) - Dr. Jerome Schubert
In this high pressure/high temperature (HP/HT) laboratory, we measure gas viscosities with extended ranges of temperatures, pressures, gas specific gravities, and quantities of non-hydrocarbons. These data will be used to extend the range of applicability of the correlation to 400°F and at least 25,000 psia. We also have a Chandler 7600 HPHT mud viscometer. With this we measure the rheological properties of drilling fluids to 600°F and 40,000 psia.

Hydraulic Fracture Conductivity Laboratory (613) - Dr. Dan Hill/Dr. Ding Zhu
The Hydraulic Fracture Conductivity Lab was established to simulate the hydraulic fracturing fluid pumping, fracture closure, and to measure the fracture conductivity over closure stresses.

It mainly consists of 1) the fluid injection module; 2) the closure stress application unit; 3) the conductivity cell assembly; and 4) the data acquisition system. The fluid injection module can flow single phase gas, liquid, as well as proppant loaded cross-linked gel at flow rates equivalent to field applications. The hydraulic load frame can apply fracture closure stress up to 15,000 psi on rock samples with dimensions recommended by ISO 13503-5 at stress application rate of 100 psi/minute. The modified API conductivity cell can accommodate samples up to 6 inches thick in total, which makes it reasonable to account for fluid leakoff during the experiment. The data recorded in the experiment include differential pressure across the sample, sample mid-point pressure, fluid flow rate, closure stress, axial displacement of the stress loading piston, et al.

This setup has been utilized to study dynamic placement of proppants in hydraulic fractures, to investigate gel damage mechanics and optimize fracturing fluids in tight gas sands, to measure shale fracture conductivity for a variety of North America shale formations, and to explore the mechanisms of shale fracture conductivity damage by water.

Assisted by the rock characterization apparatus in testing the rock mechanical properties, scanning the rock surface roughness and analyzing the rock mineralogical compositions, the conductivity lab functions at its full capacity to tackle the perplexing problems in hydraulic fracturing and makes significant contributions to the understanding of the unconventional resources development.

Matrix Acidizing Laboratory (1001F/1001G) - Dr. Dan Hill/Dr. Ding Zhu
The matrix acidizing lab is used to simulate the acidizing process. Equipment mainly consists of the syringe pump; the brine/acid accumulator; the core holder; the data acquisition system; and the back
pressure regulator. During the experiment, the syringe pump pushes the brine/acid out of the accumulators to the core. The pressure behavior is monitored by the data acquisition system.

The syringe pump is used to pump the fluids during experiment, either in constant flow rate mode or constant pressure mode. With two cylinders, it can continuously deliver flow rate, over a range of 0.1 ml/minute to 400 ml/minute, at a pressures range of from atmospheric to 7,500 psi. The accumulators are used to store brine/acid in the system. A Teflon piston is set inside the accumulator, which separates the accumulator into two chambers with one side filled with hydraulic oil and the other side filled with brine/acid. The core holder has three sizes: a 1-in diameter by 6-in length, a 1.5-in diameter by 20-in length, and a 4-in diameter by 20-in length. They have excellent corrosion resistance and capable to withstand a working pressure of 3,000 psi and temperatures of 300°F. The data acquisition system includes a pressure transducer, a NI signal processing board, and a computer installed with Labview software. It writes the pressure drop into a local file every 0.5 second. The back pressure regulator is used to create a pre-set fluid pressure before the experiment. It can support 6,000 psi pressure at maximum. This setup has been utilized to study the wormholing efficiency under different conditions. With high range back pressure regulator, the carbon dioxide behavior during acidizing can also be studied.

Multiphase Flow Loop Tower Lab - Entire Building with Remote Access (601) - Dr. Peter Valko/Dr. Rashid Hasan
Tower Lab. Petroleum Engineering Department at Texas A&M designed and built a 140-ft tall vertical flow loop (see adjacent figure14) to investigate various aspects of two-phase flow. The loop can use pipes of various sizes (1 to 6-in ID) to investigate flow through a single tube or through an annulus. The ability to capture high-speed video and pressure at various locations creates unique potential for a multi-media database for two phase upward flow.

Texas A&M is in the forefront of the new wave of research focused on understanding the dynamic interaction of wellbore and formation under loading conditions. The TowerLab, has been rebuilt for this purpose. During a 3-yr period, research within the Tower Lab has collected a considerable amount of experimental data. Dr. Valko and Dr. Hasan wish to address one of the identified weaknesses of current models: the lack of connection between critical rate correlations and wellbore hold-up correlations. They plan to make modifications to the TowerLab main loop, in order to observe hold-up both in the section above and below the entry point of the gas-liquid mixture. By direct comparison to hold-up results obtained with bottom entry, they will attempt to better understand the partial flow reversal phenomenon needed to fully understand liquid-loading. Their ultimate goal is to improve existing hold-up correlations and to quantify liquid accumulation rate in the well. They plan to use these results to develop a coupled dynamic model of the well/reservoir system. They have recently developed the concept of multi-phase zero-flow pressure (MPZFP, P0) that would be utilized in their model to enable the determination of flow direction (well to formation or vice-versa) in the individual connections. Experimental results and new correlations are the main technical deliverables of this project.

Naturally Fractured Reservoir and Fluids Lab (802) - Dr. David Schechter
Projects in this labs include the Investigation of Surfactants in Frac Fluids for Wettability Alteration, Wettability Alteration in the Wolfcamp Reservoir with Surfactant and Nano-Fluid Additives, Simulation
of Discrete Fracture Networks, and Development of a Simulation Model for the Washburn Granite Formation

Productivity Enhancement Lab (720) - Dr. Hisham Nasr-El-Din
The Productivity Enhancement Lab addresses the key factors for well productivity improvement through a wide range of research studies, including optimized acid stimulation strategies and enhanced oil recovery flood experiments. Equipment listed below:

- Density Meter DMA 4100 M - Provides unparalleled ease of use and state-of-the-art digital density measurement.
- Spinning Drop Tensiometer - Developed for the measurement of interfacial tension, surface tension, absorption rate and particularly applicable to values of interfacial tension below 1 mN/m and especially below $10^{-2}$ mN/m, as may occur when employing surfactants for enhanced oil recovery.
- Bohlin CS (Constant Stress) - Advanced and accurate rheometer for measuring rheological properties on a wide variety of materials, for example cement paste or materials such as oils or admixtures.
- SP600 - A single-beam spectrophotometer. The instrument performs a self-test as soon as it is turned on, confirming proper operation and performance of all key components.
- Drop Shape Analysis Apparatus - Used for the evaluation of drop shapes and provides the user with a universally applicable tool for determination of physical properties such as the interfacial tension and the contact angle but also for observation of heat- and mass transfer phenomena at elevated pressures and temperatures.
- Coreflood System - A system that passes a fluid (gas or liquid) through a core sample at controlled pressure and temperature conditions and measures or monitors flow parameters. These systems are used for a wide variety of experimental research in the laboratory to develop, evaluate or prove concepts in the laboratory that will improve oil recovery and production in the field.

Ramey Thermal Recovery Studies and Chemical Analysis Laboratory (508) - Dr. Maria Barrufet

Thermal Recovery Studies

1. In-situ combustion (ISC): One-dimensional combustion tube set-up consists of combustion tube assembly, pressure, temperature, and flow monitoring system, and a gas analyzer. The experimental results obtained from combustion tube experiments are used to calculate the most important design parameters (air requirements, pump selection, well configuration, etc.) to field-scale implementation of ISC.

2. Steam Flooding (SF): One-dimensional steam flooding experimental set-up consists of one-dimensional stainless steel tube, steam generator, pressure, temperature, and flow monitoring system, and a gas chromatogram. The experimental results obtained from steam flooding experiments are used to calculate some important design parameters (SOR, Energy input, GHG emissions, etc.) for the field-scale application.

3. Steam Assisted Gravity Drainage (SAGD): Two-dimensional SAGD consists of two stainless steel concentric cylinders, steam generator, pressure, temperature, and flow monitoring system, and a gas chromatogram. The experimental results obtained from SAGD experiments are used to calculate some important design parameters (Steam chamber development SOR, Energy input, GHG emissions, etc.) for the field-scale application.
4. **Electromagnetic and Electrical Heating**: One-dimensional experimental set-ups consist of one-dimensional core holders, pressure, temperature, and flow monitoring system, and a gas chromatogram.

5. **Three-dimensional experimental set-up for thermal recovery application**: This set-up is designed to simulate the quarter of a reservoir for any thermal recovery application in three-dimensional setting.

### Chemical Analysis

1. **Saturates/Aromatics/Resins/Asphaltenes (SARA)**: ASTMD2007-11 method is used to determine the SARA fractions of crude oil and bitumen samples.

2. **Thermal Gravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC)**: Reactivity of solid and liquid samples can be determined at different heating rates under different gas environment.

3. **Fourier Transform InfraRed Spectroscopy (FTIR)**: Molecular structure of liquid and solid samples can be determined with the functional group. The change in molecular structure in solid or liquid samples can be defined before and after any EOR application.

4. **Contact Angle and Interfacial Tension Measurements**: Contact angle measuring systems provide a wide range of high-performance solutions for studying the surfaces of rock and hydrocarbons.

5. **Particle size analyzer and microscope**: Used to determine nanoparticle and colloidal particle sizes, emulsion type determination, and thin section analysis for rocks.

6. **Zeta Potential Measurement**: Zeta Potential measures the potential difference between surface charge of colloids and its suspending liquid. The electrostatic forces acting on the reservoir rocks and fluids are observed to determine wettability change, asphaltene precipitation mechanism, and emulsion formation mechanism.

7. **Rheometer and density meter**: Dynamic viscosity and density of reservoir fluids are determined at different temperatures. Rheological behavior of the crude oils can be determined for the fluids having viscosity up to 4,000,000 cP.

8. **Total Dissolved Solid (TDS), pH, and conductivity props**: pH, TDS, and conductivity of produced water samples due to thermal recovery application can be monitored to observe the level of contamination in water.

9. **Reaction of Acids with Reservoir Rocks Lab (813)**

10. **Illustrations below**: Rotating disk apparatus is used to study reactions between fluids and solid surfaces. It is one of the important tools to collectively study the effects of mass transfer and chemical reactions by varying rotational speed and reaction temperature. The entire range of kinetics from mass transfer limited to chemical reaction rate limited can be investigated using this apparatus.

### Reaction of Acids with Reservoir Rocks (813) - Dr. Hisham Nasr-El-Din

In this lab, the Rotating disk apparatus is used to study reactions between fluids and solid surfaces. It is one of the important tools to collectively study the effects of mass transfer and chemical reactions by varying rotational speed and reaction temperature. The entire range of kinetics from mass transfer limited to chemical reaction rate limited can be investigated using this apparatus.

### Rheology of Non-Newtonian Fluids (812) - Dr. Hisham Nasr-El-Din

This lab focuses on the rheology of complex fluids. This lab is equipped with a rheometer, a coreflood...
setup, and an auto titrator.

- **Auto titrator** - Measurements of potential to determine total acid number (TAN) with KOH in IPA as titrant and total base number (TBN) with HCl in IPA as titrant.
- **Karl-fisher** - Measurement is done with the Pt-electrode to determine the water composition of crude oil sample.
- **Rheometer** - Viscosity and dynamic rheological properties can be measured using the Rheometer. The rheometer and a nitrogen tank are used so high temperature and high pressure can be applied, up to the limits of 500°F and 1000 psi.
- **Coreflood Setup** - Coreflood testing can be done with this setup at different temperatures. The core is 6-in long and 1.5-in in diameter. A hydraulic pump, three fluid accumulators, coreholder, pressure transducer, and hand pump are used. The transducer is connected to a computer and the data will be recorded. It is also good for core 20-in long and compatible for gas injection tests.

**Rock Cutting Lab (212A)**

The Rock Cutting lab is located within the Anadarko Petrophysics Lab (212) and contains a core drill - which can cut cores from 1/2 inch to 4 inch up to 20 inch length. It also contains two diamond tipped tile saws converted to cut cores and samples. The smaller one can cut to a depth of around 3.5 inch and handle pieces of rock 3.5x24x24. The larger one can cut 6x24x24. This equipment is used for cutting cores of different properties to supply to students for experiments.

**Rock Mechanics Laboratory (614) – Dr. Zoya Heidari**

The “Rock Mechanics Laboratory” at the Harold Vance Department of Petroleum Engineering has the capabilities to measure mechanical properties of rocks to enhance geomechanical evaluation in conventional and unconventional reservoirs. This laboratory includes two conventional tri-axial rock testing systems that can simulate reservoir and pore pressures up to 20,000 psi for reliable characterization of reservoir mechanical properties. The “Rock Mechanics Laboratory” enables measurements of (a) elastic properties of the rocks such as Young’s modulus, Poisson’s ratio and Bulk modulus, (b) poroelastic constants such as Biot’s coefficient and Skempton’s pore pressure coefficient, (c) time-dependent viscoelastic deformations, and (d) acoustic-wave velocities in saturated and dry rock samples. The outcomes of the rock mechanics evaluation in the “Rock Mechanics Laboratory” can be used in drilling, geomechanical modelling, fracture characterization, and formation evaluation research at Texas A&M University.

**Wellbore Acoustics Lab (621) - Dr. Dan Hill/Dr. Ding Zhu**

Distributed acoustic sensing (DAS) data is currently being used to monitor flow events. DAS data can identify where fluid is being produced from a perforation or hydraulic fracture and it can be used to qualitatively determine where fluid is being injected into the formation during the hydraulic fracturing process. DAS data however has not been used to quantify these flow rates.

The acoustic lab is currently working to understand how acoustic data from wellbore sounds can be used to quantify fluid flow rates, fluid distribution during production and injection, and fluid saturation. The acoustic lab consists of a simulated hydraulically fractured well. Sound from production into this simulated well is recorded and processed with signal processing components and related to production rates.

The simulated fractured well consists of casing, perforation tunnel and a proppant filled fracture. The
casing is 4 ft long, and has an outer diameter of 5 1/2-in and inner diameter of 4 7/8-in. The perforation tunnel has a diameter of 0.5-in. The proppant filled fracture has a width of 0.2-in., length of 2-ft and height of 1-ft. The proppant filled fracture is connected to the well through the perforation tunnel. Fluid is injected into one end of the fracture and is produced into the well through the perforation tunnel. The signal processing components consist of a B&K type 8103 hydrophone, a Nexus conditioning amplifier, NI-9234 data acquisition device, Labview, and Matlab software.

Rock-Fluids and IOR Lab (810) – Dr. Robert Lane
This laboratory is used to investigate the physics and chemistry of various interactions of reservoir fluids, introduced fluids and reservoir rock. Equipment includes unconfined imbibition measurement apparatus, unconfined rock strength measurement equipment, core flood apparatus, emulsion evaluation protocol and pH measurement equipment. Aging cells for studying rock-fluid interactions over time and at elevated temperature and pressure are stored and filled in this lab, for placement in roller ovens in RICH 201.

Tommie E. Lohman Fluid Measurement Laboratory (201) - Dr. Robert Lane
Primarily used for teaching, this laboratory is used for short research testing, and provides equipment and procedures for the physical analysis of oilfield fluids including oilfield emulsions, water and sediment in oils, and gas and liquid metering. A working water well is used in conjunction with the lab for analysis of transient pressure and sucker rod pumps. As an instructional facility, its main focus is for production engineering where students are trained in the acquisition and evaluation of fluid data with an emphasis on development of procedures for handling oilfield fluid samples.

Equipment and experiments include:
- Two gas “reservoirs” of 120-gallon volume, each outfitted with accurate pressure gauges and mass flow meters so that two teams of students can perform P/Z reservoir depletion and projected ultimate recovery experiments simultaneously.
- Two Fluid Friction Pressure stations for measuring liquid friction pressure drops through various sized pipe with different surface roughness, including effects of pipe bends and presence of valves and similar flow restrictions. The experiments are relevant to design of well tubing, surface piping and related hardware.
- Two Gas-Liquid two phase flow loops with 3-inch, 2-inch and 1-inch clear piping for determining two-phase flow regimes in horizontal and vertical flow. In addition to setting up various flow regimes by varying air and water throughput, students relate the various regimes to such diverse phenomena as gas lift, liquid holdup/loading and slugging problems during production.
- Two Twin Centrifugal Pump benches. The two pumps on each bench can be arranged singly, in parallel (mimics high flow rate/low pressure drop of liquids at the surface) and in series (mimics two stages of an electrical submersible pump). Experiments lead to computation of pump efficiency, pressure head, horsepower, recommended operating range and effects of added pump stages. Limitations of C-pumps, such as cavitation and loss of prime are also examined.
- Three phase separator benches. The acrylic separators are transparent so that students can design and observe efficient separation of air, water and hydraulic oil as well as process upsets such as emulsion formation and carryover. Fluid input flow rates are measured with pitot tube (air), turbine meter (water) and gear meter (oil). Separated liquid drainage rates are measured with sonic meters attached to drain lines.
In addition to the above equipment with two workstations each, the lab’s gas flow loop with three spools containing different size orifice plates has been upgraded with upstream and downstream variable chokes, mass flowmeter, and Barton gauges so that students can become familiar with methodology of field gas flow measurement.

**Unconventional Rock Physics Laboratory (1001B) - Dr. Zoya Heidari**

The Unconventional Rock Physics Laboratory at the Harold Vance Department of Petroleum Engineering is a newly established laboratory for petrophysical evaluation of unconventional rocks including organic shale. The object is to develop new measurement techniques for petrophysical properties as well as new technologies for interpretation of rock physical properties such as dielectric permittivity and electrical resistivity. For instance, we investigate the application of nanotechnology in fracture characterization and petrophysical evaluation of tight unconventional reservoirs. This laboratory currently has the capabilities of synthesizing nanoparticles as well as permeability measurements in tight reservoirs. The projects in this laboratory are aligned with the objectives of The Texas A&M Joint Industry Research Program on “Multi-Scale Formation Evaluation of Unconventional and Carbonate Reservoirs.”
Research Programs

Acid Stimulation Research Program (ASRP) JIP
During 2012, the Acid Stimulation Research Program (ASRP) initiated a cutting-edge program focusing on matrix acid stimulation. In response to the current industry demand to focus on issues of sandstone and carbonate acidizing, we have expanded our research, with projects ranging from fundamental studies of new chemical systems to optimization of treatment design. New theoretical models are being developed in the program, and implemented in computer software. Experimental components of the program use core and outcrop material from sponsors around the world in order to capture the effects of the unique petrophysical properties of these formations. ASRP builds on the foundation of carbonate acidizing research developed in the Middle East Carbonate Stimulation Research program. The principal investigators leading this program are Dan Hill, Hisham Nasr-El-Din, and Ding Zhu. Other faculty researchers collaborating are Zoya Heidari and Mashhad Fahes. The individual projects included in ASRP are:

- Effects of Core Geometry and Treating Conditions on Wormhole Breakthrough Pore Volume in Carbonate Stimulation
- The Role of Permeability in Carbonate Matrix Acidizing
- Limited Entry Perforating Design for Acid Placement in Horizontal Wells
- Integrated Optimization of Carbonate Matrix Acidizing Design
- Effects of Acid Additives on Carbonate Acidizing
- The Influence of Seawater, Produced Waters and Other Saline Waters on Acid Reaction with Carbonate Rocks
- The Impact of Hydrolysis on the Performance of VES-based Acids
- Formation Damage due to Iron Precipitation
- The Effect of CO2 Solubility Limitations on Spent Acid Recovery
- A Quantitative Application of Well Logs to Improve Prediction of Acid Stimulation in Carbonate Formations
- Petrophysical Rock Classification Using Conventional Well Logs to Detect Zones for Acid Stimulation in Carbonate Reservoirs

Current committed and expected industry sponsors include: Baker Hughes, Pemex, BG Group, Petrobras, Chevron, Qatar Petroleum, ConocoPhillips, Saudi Aramco, Halliburton, Shell, Maersk, Schlumberger, and Total.

Crisman Institute for Petroleum Research
The mission of the Crisman Institute for Petroleum Research is to produce member-driven advances in upstream petroleum engineering technology through combined efforts of faculty, post-doctoral researchers and graduate students, in close cooperation with industry. A critical component of that mission is the production of mission-ready graduates for hire. During spring semester 2014, there are 21 member companies providing and 38 graduate students being supported by Crisman Institute funds.

The Institute is customer focused; industry representatives help identify problems of major significance and prioritize proposals submitted by faculty. Members support projects of particular
interest to them through membership at the Institute. Members support graduate students and post-doctoral researchers and have opportunities for close contact with them through twice-yearly reviews plus special field office trips.

Crisman Institute membership includes exploration and production, oilfield service and consultancy companies from North and South America, Europe, Asia and Australia. Outreach and technology transfer to members takes several forms. Twice yearly two-day research reviews in College Station generally have 30 – 40 attendees in person with 20+ attendees on the web. For companies within driving distance of College Station, a subset of faculty and students make on-request visits to company sites to review projects of interest. The Institute publishes monthly newsletter and an annual report. All project reports and updates available on a member-only web site. The Institute maintains a clearinghouse of research efforts, tracking not only research in progress but also results of completed projects and perspectives on research possibilities for the future.

The Institute works with industry and government representatives to identify the most important problems now facing the upstream petroleum industry and those that are expected to arise in the future. The focus of efforts is on solutions to as many of the identified problems as possible within the framework of available resources; the intent is to develop solutions that will be immediately useful in the industry. An additional effort is to continuously upgrade the problem-solving capabilities of the Institute through ongoing faculty development strategies and pursuit of outstanding post-doctoral and graduate students.

**Global Petroleum Research Institute (GPRI)**

GPRI provides a "fast track" path for funding oil and gas joint venture research projects by administrating projects, acting as research advocate on member projects, coordinating research with other industry activities, and facilitating A&M researchers in contacting oil and gas industry.

**GPRI Marine Vibrator Joint Industry Project (MVJIP)**

GPRI is the administrative director of a new joint industry project to develop a commercially available marine vibrator source for offshore oil & gas exploration. The alternative source is to be used for marine seismic surveys in environmentally sensitive areas, for areas where a better seismic signal is needed and for certain environments like shallow water where seismic airguns are suboptimal. Three vendors have been chosen to built prototypes units; the first to be tested in the Fall of 2014.

**Environmentally Friendly Drilling (EFD)**

GPRI is one of the principals in the Environmentally Friendly Drilling Program (EFD), a collaborative effort to lower the environmental footprint of oil and gas drilling and production in onshore operations. Since 2001, the team has provided research and technical services in new methods to treat oil field produced brines and make it available for re-use. A recent initiative has begun to indentify advanced analytical techniques required to document the effectiveness of produced water cleanup and the aid in the design of high performing fracturing chemical packages for high salinity systems.
Heavy Oil, Oil Shales, Oil Sands & Carbonate Analysis and Recovery Methods (HOCAM) JIP
The HOCAM is a research group organized by Dr. Berna Hascakir focused on education and research for the recovery of unconventional oil resources with very low API gravity. The main objective of HOCAM is to find environmentally friendly and economic production solutions for challenging reservoirs including heavy oil, oil shale, oil sand, and carbonate host-rock environments. Our ultimate goal is to educate and train engineers on finding practical solutions for the recovery of these unconventional oil resources using thermal enhanced oil recovery (thermal-EOR) methods.

We bring new insights to the thermal-EOR methods with the application of unconventional technologies such as smart well technologies and seismic monitoring to track thermal fronts. This is expected to reduce environmental footprints and minimize the production cost of oil per barrel. Our solution strategies are empowered with the interdisciplinary vision of the research team.

As the success of any thermal-EOR method highly depends on the chemical, thermal, and other physical properties of the reservoir rock and fluids, we propose to extend one-dimensional experimental studies for dynamically tracking the thermal front behavior to the more natural three-dimensional environment. Furthermore, our ability to continuously measure the chemical and physical changes in oil, water, gas, and rock allows us to understand the degree of upgrading in oil. We are also developing solutions to manage water and gas produced in the process. All this is complemented with our development of simulation plug-ins compatible with existing commercial reservoir simulators that will allow overcoming uncertainties regarding oil-field properties or the thermal recovery process itself.

Model Calibration and Efficient Reservoir Imaging (MCERI) JIP
The MCERI (Model Calibration and Efficient Reservoir Imaging) industrial research consortium at Texas A&M University has been at the forefront of reservoir modeling, history matching, and streamline simulation technologies for well over the last decade. Much of the mathematical foundations behind modern streamline simulation have been developed in the research consortium, which is co-directed by Dr. Akhil Datta-Gupta (datta-gupta@tamu.edu) and Dr. Michael J. King (mike.king@pe.tamu.edu). Dr. Datta-Gupta and King co-authored the SPE textbook on the subject, ‘Streamline Simulation: Theory and Practice’. The research consortium continues to be one of the most active centers for the development of streamline technology and its applications to reservoir management and optimization, multi-scale data integration and history matching, upscaling/upgridding, and more recently, performance analysis and optimization of unconventional wells.

Reconciling high resolution geologic models to dynamic data such as transient pressure, tracer and multiphase production history or time-lapse seismic data is by far the most time-consuming aspect of the workflow for both geoscientists and engineers. The situation is further complicated by the rapid progress in well-construction technology and the advent of smart wells and permanent down-hole sensors. The amount of data collected is increasingly becoming overwhelming and there is an immediate need to improve our capabilities to utilize the data in a timely and efficient manner. Furthermore, as the use of time-lapse seismic becomes more common in the industry, there is also an increasing demand for quantitative and efficient use of these data for reservoir characterization in addition to reservoir monitoring. A focus of the MCERI research consortium has been the
development of novel techniques and efficient workflows for reconciling high resolution geologic models to pressures, rates, fluid production and time lapse seismic response. This includes geologically consistent regionalization and re-parameterization, identification of spatial distribution of reservoir properties, and uncertainty quantification.

How coarse is coarse and how fine is fine? This is an often asked question in reservoir simulation and modeling. We have developed novel adaptive upgridding algorithms to address this question through the design of simulation grids that optimally preserve the reservoir heterogeneity and geologic features. These techniques have been extensively applied to simulation layer design for both conventional and unconventional reservoirs.

A more recent focus of the MCERI consortium has been development of novel approaches for performance analysis and optimization of unconventional wells. We have introduced novel fast marching methods for visualization of well drainage volumes in the presence of hydraulic and natural fractures. The fast marching methods can be orders of magnitude faster than conventional reservoir simulators and allow for efficient computation of pressure and rate transient response, matrix-fracture parameter estimation and optimization of well completion strategy.

A major emphasis of the MCERI research consortium has been field application and validation of the novel technologies in close collaboration with the industrial partners.

**Multi-Scale Formation Evaluation of Unconventional and Carbonate Reservoirs JIP**

The “Multi-Scale Formation Evaluation of Unconventional and Carbonate Reservoirs” is a newly established Joint Industry Research Program (JIP) in the Petroleum Engineering Department of Texas A&M University with Dr. Zoya Heidari as PI. This research program is established in September 2012, with five current sponsors including BHP Billiton Petroleum, BP, Chevron, ConocoPhillips, and Devon Energy. The long-term goals of the Texas A&M Multi-Scale Formation Evaluation Research Program include:

- **Goal 1:** To develop new methods, algorithms, and work flows in a format that can be directly and easily used in the petroleum industry to solve challenging problems in formation evaluation and reservoir characterization for unconventional and carbonate reservoirs,

- **Goal 2:** To develop new laboratory measurement techniques to characterize organic shale and carbonate cores using NMR, electrical resistivity, dielectric, and other measurements, and

- **Goal 3:** To train professional petrophysicists and petroleum engineers for the future of the petroleum industry and potential scientists for academia.

Our roadmap includes integration of multi-scale formation data for reliable formation evaluation and reservoir characterization. To successfully fulfill our objectives, we collaborate with faculty from different departments within Texas A&M University such as Nuclear Engineering department, Integrated Ocean Drilling Program, and Geology and Geophysics department as well as with scientists and engineers from other research institutes and universities.
Reservoir Modeling Consortium (RMC)
The RMC was organized in the mid-1980s by Dr. Robert Wattenbarger as a means of doing research on various aspects of reservoir and well performance. The common thread has been the use of mathematics and reservoir models to match and forecast field performance. Over the years the emphasis has changed, but the current emphasis is entirely on shale gas and oil wells.

The past shale well work has been mainly focused on (correcting and) applying analytical solutions to shale gas well performance. The emphasis has now shifted more to shale oil simulation and multi-phase flow considerations. Water flowback analysis has been successfully applied to shale gas wells that have good flowback data after fracing shale gas wells. The flowback data can be used to directly estimate the volume of the hydraulic fractures. The analysis also shows how the signature of gas and water type curves are affected by the flowback period. Some of the linear flow and bilinear flow slopes are modified or eliminated. This work will be continued as maybe applied to shale oil wells.
Faculty Research Areas/Interests

Yucel Akkutlu
Yucel Akkutlu’s main research interest is theoretical description of fluid flow, heat/mass transport and reactions in porous media. His work finds applications in reservoir engineering, particularly in the areas of petrophysics, IOR/EOR and unconventional oil and gas recoveries. His recent work focuses on fundamental problems of gas storage and transport in organic-rich shales in the laboratory and developing multi-scale simulation models for shale gas and oil production.

Walter Ayers
Walt Ayers’ research interests center on Petroleum Geology, include conventional and unconventional reservoirs, as well as CO₂ sequestration in geologic media. He has conducted research on, and has advanced understand of, shale gas and oil and coalbed methane reservoirs and their resources, worldwide, and the results have been published in more than 150 papers, reports and conference proceedings. Dr. Ayers has managed several major field studies that integrated geology, hydrology, petrophysics, and engineering. Over the past 12 years, he has developed and taught a graduate course on unconventional oil and gas, and he has taught numerous unconventional reservoir courses for the oil and gas industry over the past 25 years. Dr. Ayers has advised 3 Ph.D., 10 M.S. (thesis), and 13 M.Eng. (report, non-thesis) students.

Maria Barrufet
Maria Barrufet’s research areas are in reservoir and production engineering; her expertise includes thermodynamics and transport phenomena applied to Miscible, Thermal and Chemicals Enhanced Oil Recovery processes. Dr. Barrufet’s group has published over hundred articles in characterization and constructing reservoir fluid models from heavy oils to gas condensates and gas injection processes, prediction of gas hydrate formation with and without thermodynamic inhibitors, and leak detection methods in subsea flowlines. Her work also includes modeling and experimental determination of phase equilibria of hydrocarbon systems with water, insitu oil combustion, radiation thermal cracking, and rheological measurements.

Thomas Blasingame
Tom Blasingame's research efforts deal with topics in applied reservoir engineering, reservoir modeling, and production engineering. Dr. Blasingame has made numerous contributions to the petroleum literature in well test analysis, analysis of production data, reservoir management, evaluation of low/ultra-low permeability reservoirs, and general reservoir engineering (e.g., hydrocarbon phase behavior, natural gas engineering, inflow performance relations, material balance methods, and field studies). To date (September 2013), Dr. Blasingame has graduated 51 M.S. (thesis), 30 M.Eng. (report, non-thesis), and 11 Ph.D. students, and he has performed several major field studies involving geology, petrophysics, and engineering tasks.

Akhil Datta-Gupta
Akhil Datta-Gupta is Regents Professor and holder of L. F. Peterson ’36 Endowed Chair in Petroleum Engineering at Texas A&M U. in College Station, TX (USA). Dr. Datta-Gupta is well known for his contributions to the theory and practice of streamline simulation in petroleum reservoir characterization, management and calibration of high resolution geologic models. Dr. Datta-Gupta received two of the top three technical awards (Carll Award, 2009; Uren Award, 2003) given by the
Society of Petroleum Engineers (SPE) for his contributions related to reservoir characterization and 3-D streamline simulation. Dr. Datta-Gupta has twice won the prestigious SPE Cedric K Ferguson Award, first for introducing streamline-based analytic sensitivity calculations and second for introducing the concepts of ‘generalized travel time inversion’, leading to novel technologies for calibration of high resolution geologic models. In 2007 he coauthored the SPE textbook 'Streamline Simulation: Theory and Practice' that, for the first time, lays down the foundations of modern streamline simulation technology. He is an SPE distinguished member (elected, 2001), distinguished lecturer (1999-2000), distinguished author (2000) and was selected as an outstanding technical editor (1996). In addition to his SPE awards, he is recipient of the AIME Rossitter W. Raymond award (1992), the U.S. Department of Energy Award for Outstanding Contributions to Basic Research in Geosciences (2008) and served as member of the Polar Research Board of the National Academy of Sciences (2001-2004) and the Technology Task Force of the National Petroleum Council (2007). His research program is funded by NSF, DOE and oil companies world-wide. Dr. Datta-Gupta was elected to the U.S. National Academy of Engineering in 2012.

Christine Ehlig-Economides
Christine Ehlig-Economides is currently pursuing several research areas. She has completed a number of studies related to shale oil and gas and currently is working on research integrating microseismic and hydraulic fracture treatments and on enhancing a recently developed model for the injection-falloff portion of fracture calibration tests. She also is pursuing research on modeling in situ oil shale conversion and production. She also has students doing research related to new technologies for transporting natural gas from deepwater reservoir production facilities in order to improve oil production limited by the need for injection of associated gas. She also has a project investigating whether offshore Mediterranean fields show similar properties to those in the Gulf of Mexico. Finally, she has two projects related to broader energy topics: one is about the use of currently flared associated gas from shale oil production for drilling and hydraulic fracturing; the other is comparing energy, water, air quality, and land footprint for producing ethanol from corn versus from natural gas.

Eduardo Gildin
Eduardo Gildin expertise is in the area of control of dynamical systems, the mathematics of reservoir simulation, numerical methods for control and model reduction of large-scale systems, finite element modeling, numerical analysis and optimization with an emphasis on petroleum engineering problems.

Rashid Hasan
Rashid Hasan is an expert in the areas of production engineering; he focuses on modeling complex transport processes in various components of petroleum production systems. Dr. Hasan’s group has pioneered systematic modeling of heat transfer in wellbores; their contributions in modeling heat transport in extreme conditions are widely recognized for their value in, among other aspects, production safety analysis. His present research attempts to model transient fluid and heat flow for the purpose of flow assurance, flow metering, and pressure transient testing. His on-going work on casing pressure buildup analyses has strong implications for production/operations safety and design of tests for checking well integrity.
Berna Hascakir
Berna Hascakir’s research interests center on heavy oil and oil shale recovery by thermal enhancement, challenging reservoirs, thermal front tracking, and the environmental impact of thermal recovery. For the heavy oil and the oil shale recovery using thermal enhanced oil recovery methods, she focuses on in-situ combustion, hot fluid injection (steam/hot water/hot gas flooding, steam assisted gravity drainage, and cyclical injection); and Electrical and Electromagnetic heating. The challenging reservoirs she is interested in are tight heavy oil reservoirs, carbonates, reservoirs with a strong aquifer, and oil shales. Regarding thermal front tracking, she is interested in computerized tomography and 4D Seismics.

Zoya Heidari
Zoya Heidari’s research focus is on multi-scale formation evaluation, petrophysics, rock physics, borehole geophysics, well logging, inverse problems, and Formation Evaluation of unconventional reservoirs. She has established a strong research program in the field of formation evaluation in the petroleum Engineering Department of Texas A&M University. This research program focuses on developments in well-log interpretation techniques, numerical simulation of near wellbore problems, core analysis, pore-scale numerical simulations, new technologies for borehole measurements, and multi-scale interpretation methods for unconventional reservoirs. Dr. Heidari is the founder and director of the Texas A&M Joint Industry Research Program (JIP) on “Multi-Scale Formation Evaluation of Unconventional and Carbonate Reservoirs.” Dr. Heidari’s research activities have significant contribution in developing new rock physics models for reliable formation evaluation of challenging tight reservoirs such as organic-shale formations. Her multi-cultural and diverse research team currently includes seven Ph.D. students and five M.Sc. students. Dr. Heidari has presented her work in 38 journal publications and conference papers as well as several invited talks.

Dan Hill
A. Daniel Hill has been conducting research in petroleum production engineering for almost 40 years, with particular emphasis on well stimulation. He is a recognized expert on matrix acidizing, acid fracturing, fracture conductivity, wellbore diagnostics, and production logging. His research program over the years has resulted in the completion of more than 60 M. S. and 31 Ph.D. degrees, and publication of about 75 refereed journal articles and more than 165 conference papers. Hill’s research is currently funded by multiple RPSEA grants, a JIP called the Acid Stimulation Research Program, a large grant from Petrochina, and other grants from individual companies including ExxonMobil, Shell, and Petrobras.

John Killough
John Killough's research efforts deal with the areas of applied reservoir engineering, reservoir modeling, and reservoir simulation. Professor Killough has been one of the pioneers in the application of high performance computing to reservoir simulation and now heads a group of international researchers in this area. During his academic career he has advised more than twenty master’s and Ph. D. students who currently work in the petroleum industry. The research activities of Prof. Killough’s group involve enhanced reservoir simulation from the nano-scale to the scale of large fields with thousands of producing wells. Specific topics include unconventional oil and gas production as well as fractured carbonate reservoirs. The primary goal of this research group is to provide realistic simulations which will enable engineers to better understand and to improve hydrocarbon recovery from the complex reservoirs currently being produced.
Michael King
Mike King’s research interests include reservoir engineering and reservoir modeling, with special expertise in fluid flow, reservoir simulation, upscaling of geologic models for flow simulation, streamline modeling, and 3d reservoir modeling workflows. Provided an analytic analysis of waterflood performance which explained flood stability in petroleum reservoirs. Developed the "time of flight" formulation which underlies all of the modern streamline simulation technology. Developed the high resolution "half cell transmissibility" technology for improved upscaling of geologic models for flow simulation. Developed statistical error analysis techniques for design of the flow simulation grid ("upgridding") based upon a 3d geologic model and its properties, and developed "dual scale" modeling approaches which enhance geologic and simulation multi-disciplinary project integration. Co-author of the SPE textbook on Streamline Simulation: Theory and Practice. Continuing active research in upscaling, streamline methodologies, now with extensions to unconventional resources.

Robert Lane
Robert Lane’s research has centered on subsurface water management. This has included significant efforts in the laboratory and in the field to improve and implement chemical systems for minimizing excess water (or gas) production as well as improving sweep for reservoir drive fluids in IOR or EOR processes. More recent work has involved evaluation of the importance of chemical interactions of hydraulic fracture fluids with rock during source rock stimulation operations, including determination of the fate of fracture fluid components in the reservoir and in flowback waters. He is also determining changes in rock mineralogy and in flowback water salinity due to hydraulic fracturing of source rocks, including to date samples from the Barnett, Marcellus, Mancos and Eagle Ford formations. Additional work has focused on applications of nanoparticle technologies to improving hydrocarbon recovery. The focus to date has been on non-thermal recovery of heavy oil with nanoparticle-stabilized water-external emulsions generated in the reservoir and on use of nanoparticles to minimize imbibition of fracture fluid into nanometer sized pores in source rock reservoirs. Dr. Lane is interested in most aspects of reservoir and production chemistry.

Jiajing Lin
Jiajing Lin’s research interests include modeling the performance of fractured reservoir in shale gas reservoir and predicting the performance of the horizontal well. She has developed a new semi-analytical solution to analysis the production of the fractures in complex reservoir which saves the computing time compared to the numerical method. Dr. Lin is working on combine the performance model (hydraulic fracture model) with the simulation of fracture networks model. She has presented numerous of papers at conferences and meetings.

William McCain Jr.
William McCain is involved with unconventional reservoirs research, investigating how the confinement effects should be introduced to a wet-gas shale reservoir flow simulation study. If the confinement effects are significant, then it would be relatively easier to capture it with a wet gas shale system, which could then be an appropriate intermediate step to a future investigation on the condensate and oil reservoirs.
Priscilla McLeroy
Priscilla McLeroy’s research and teaching focuses on the intersection of risk & uncertainty decision analysis within integrated conventional and unconventional oil & gas projects. Within this focus, she contributes systems engineering principles (e.g., dynamic modeling of complex systems decisions, oil & gas innovation and diffusion, energy systems value creation and field studies). Exemplifying her oil & gas systems view are articles appearing across petroleum upstream, midstream, downstream (including petrochemical), economics and policy journals. Professor McLeroy has conducted research and advised numerous national and international organizations, including non-US government regulatory agencies. She has led integrated teams of geoscientists, petroleum engineers, and economists through major field studies from basin analysis to mature asset redevelopments.

Duane McVay
Duane McVay’s primary research focus is on uncertainty quantification. He supervises a group of graduate students working in three broad areas of uncertainty quantification: 1) improved methods for assessing uncertainty, 2) calibration of uncertainty assessments to improve their reliability, and 3) assessment of the value of assessing uncertainty. The research is conducted in a variety of petroleum engineering contexts, including well construction, production forecasting, decline curve analysis, reservoir simulation, reserves and resources estimation, portfolio optimization, and economic analysis, and is applied in both conventional and unconventional reservoirs.

George Moridis
George Moridis has been a Staff Scientist in the Earth Sciences Division of LBNL since 1991, where he is the Head of the Hydrocarbon Resource Program, is in charge of the LBNL research programs on hydrates and tight/shale gas, and leads the development of the new generation of LBNL simulation codes. Moridis is a visiting professor in the Petroleum Engineering Dept. at Texas A&M University, and in the Guangzhou Center for Gas Hydrate Research of the Chinese Academy of Sciences; he is also an adjunct professor in the Chemical Engineering Dept. at the Colorado School of Mines, and in the Petroleum and Natural Gas Engineering Dept. of the Middle East Technical University, Ankara, Turkey. His primary area of interest is unconventional resources, and he specializes in the numerical simulation of complex flow and transport multi-phase, multi-component processes in the subsurface, i.e., describing the coupled flow, thermal, thermodynamic (including phase changes), chemical, geomechanical and geophysical processes (and their interdependence and interactions) in geological systems. Additionally, he is involved in High-Performance Computing, and leads the development of parallel codes (at both LBNL and Texas A&M) to solve these demanding numerical problems on advanced computational platforms such as clusters and supercomputers.

Hadi Nasrabadi
Hadi Nasrabadi’s main research interests are compositional simulation of multiphase multicomponent flow in porous media and phase behavior of hydrocarbon reservoirs. He has published 8 peer-reviewed articles and 14 conference papers in the areas of CO2 enhanced oil recovery, CO2 sequestration in water aquifers, well placement in gas condensate reservoirs, and modeling asphaltene precipitation. He is currently involved in research projects funded by the Qatar Foundation (on modeling asphaltene precipitation during CO2 injection) and the Crisman institute (on phase behavior of petroleum fluids in shale rocks and reservoir simulation using lattice Boltzmann method).
**Hisham Nasr-El-Din**
Hisham Nasr-El-Din has been a prolific researcher and developer of new technologies over a 40 year career that has led to important advances in petroleum engineering operations. Among other accomplishments, he has identified damage mechanisms that have resulted from various chemical treatments, designed new chemical treatments to remove iron sulfide scale, and designed new emulsified scale treatments for tight, low-temperature sandstone formations. He has examined acid additives and developed new and improved ways to stimulate sandstone and carbonate reservoirs; his investigation of the reaction of new acid systems with carbonate rock has led to great positive impacts on field treatments. He has applied innovative water shut-off techniques that are based on gelling polymer and silicates. He has trained more than 200 engineers, advised 14 PhD students and 34 Masters students to completion, published more than 175 papers in peer-reviewed journals, presented nearly 375 at conferences and meetings, and currently holds twenty US patents.

**Sam Noynaert**
Sam Noynaert is focused on drilling research, primarily related to unconventional drilling methods and reservoirs as well as drilling automation and optimization. Specific areas include coiled tubing drilling, directional drilling technologies and related issues and ROP and wellpath optimization. He is also working on issues related to horizontal and deviated wellbores such as wellbore stability, casing design and drilling hydraulics.

**David Schechter**
David Schechter’s research interest is primarily focused on Enhanced Oil Recovery (EOR) via CO2 injection with specific focus on naturally fractured conventional and unconventional reservoirs. Dr. Schechter also investigates mobility control during CO2 injection and the efficacy of wettability altering surfactants during stimulation and water injection into unconventional liquid reservoirs (ULR). The research group is also working on modelling of naturally and hydraulically fractured reservoirs. This is accomplished by using reservoir characterization data from natural and hydraulic fractures such as horizontal core, image logs and microseismic data to unravel the interaction of hydraulic and natural fractures. The group then builds maps of fracture-matrix systems and using flexible gridding schemes such as PEBI techniques, enables a mesh to be developed that explicitly incorporates matrix, hydraulic and natural fractures and their interaction. Currently, the group is capable of gridding intersecting fractures at non-orthogonal angles. Future simulation of these networks will provide a powerful tool for understanding long term performance of horizontal wells in ULR. Dr. Schechter works with numerous companies interested in CO2 EOR, naturally fractured reservoirs, EOR in ULR and combinations of these topics. He also is in charge of the new CT X-Ray scanner that is used to image static and dynamic experiments for researchers in not only the Petroleum Engineering faculty, but for other Departments in the College of Engineering. Dr. Schechter’s broad based research topics that encompass rock fluid interaction, CO2 and chemical EOR, and development of gridding and simulation software to model the phenomena promises to provide a new generation of software to model ULR and pursue the all-important topic of EOR in ULR. Dr. Schechter is a recognized expert on fracture-matrix interaction and CO2 injection via publications, invited seminars, short courses and dozens of former students working with as many companies world-wide on EOR.
Jerome Schubert
Jerome Schubert’s research currently involves lab work on low cycle cement fatigue under high temperature and high pressure mainly as related to multiple hydraulic fracture completions, behavior of HPHT gas kicks in oil based or synthetic based drilling fluids. We are designing and building (in conjunction with Dr Catalin Teodoriu at TU Clausthal) an XHPHT PVT cell to measure the PVT and solubility characteristic of natural gas and base drilling fluids, as well as measuring the effect of solution gas on the rheological properties of drilling fluids during kicks. Students have begun to work on development of a model to predict the onset of wellbore collapse and bridging during oil and gas blowouts. Dr. Schubert’s research has been sponsored by the DOI-BSEE, QNRF, RPSEA, BP, The BORA JIP, and the SMD JIP.

Peter Valko
Peter Valkó’s research interest includes i) design and evaluation of hydraulic fracture stimulation treatments; ii) performance of stimulated wells; iii) modeling, identification and optimization, including the underlying numerical techniques with special emphases on numerical inversion of the Laplace transform. In a current research project with Dr. Rashid Hasan he focuses on understanding and handling liquid-loading issues that may be the key to maintaining economic viability of many shale gas plays. Texas A&M is in the forefront of the new wave of research focused on understanding the dynamic interaction of wellbore and formation under loading conditions. The largest experimental facility within the Petroleum Engineering Building, the TowerLab, has been rebuilt for this purpose. During a 3-yr period, research within the Tower Lab has collected a considerable amount of experimental data. Dr. Valko and Dr. Hasan wish to address one of the identified weaknesses of current models: the lack of connection between critical rate correlations and wellbore hold-up correlations. They plan to make modifications to the TowerLab main loop, in order to observe hold-up both in the section above and below the entry point of the gas-liquid mixture. By direct comparison to hold-up results obtained with bottom entry, they will attempt to better understand the partial flow reversal phenomenon. Their ultimate goal is to improve existing hold-up correlations and to quantify liquid accumulation rate in the well. They use these results to develop a coupled dynamic model of the well/reservoir system capable of automatically determining flow direction through the connections.

Robert Wattenbarger
Robert Wattenbarger specializes in reservoir engineering, reservoir simulation, and well behavior. His current research focuses on mathematics and reservoir models to match and forecast shale gas and oil wells.

Ding Zhu
Dr. Ding Zhu conducts research in production engineering. She is a recognized expert on horizontal and multilateral wells, well stimulation, downhole sensor application (distributed temperature and distributed acoustics), and intelligent completion for complex well performance optimization. Her research program over the years has resulted in the completion of more than 40 M. S. and 11 Ph.D. degrees, and publication of 50 refereed journal articles and more than 130 conference papers. Zhu’s research in fracture conductivity in shale formation and using downhole sensor to diagnosis fractured wells are currently funded by RPSEA grants. She is also a co-PI of a JIP called the Acid Stimulation Research Program. Zhu has a large grant from Petrochina studying stimulation in vuggy, low-perm carbonates, and other grants from individual companies including ExxonMobil, Shell, and Petrobras.
Publications

A good measure of faculty involvement with research is publications. In the table below we listed total number of papers written by the Texas A&M University Petroleum Engineering professors in between 2009-2013 and compared with the peers. The table also includes paper per faculty during the same time period. Using both measures, it is clear that publishing performance of our faculty is high.


<table>
<thead>
<tr>
<th>University</th>
<th>No. of Papers</th>
<th>Papers/TT faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas A&amp;M University</td>
<td>89</td>
<td>4.05</td>
</tr>
<tr>
<td>University of Texas, Austin</td>
<td>72</td>
<td>2.88</td>
</tr>
<tr>
<td>University of Tulsa</td>
<td>44</td>
<td>4.00</td>
</tr>
<tr>
<td>Stanford University</td>
<td>39</td>
<td>3.90</td>
</tr>
<tr>
<td>University of Oklahoma</td>
<td>26</td>
<td>1.73</td>
</tr>
<tr>
<td>Colorado School of Mines</td>
<td>19</td>
<td>1.58</td>
</tr>
</tbody>
</table>

Part of the measure for our faculty is also related to how many times their journal articles are cited. Attached in Appendix L is a list of the Top 100 Journal Article citations for our faculty.
Budget Information

Financial Resources
In FY13 the department of Petroleum Engineering spent approximately $18.15 million to operate the department. The table below shows the actual expenditures by category.

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>Education and General</td>
<td>$3,131,586.19</td>
</tr>
<tr>
<td>State</td>
<td>Designated</td>
<td>$1,061,349.61</td>
</tr>
<tr>
<td>State</td>
<td>Distance Learning</td>
<td>$856,625.92</td>
</tr>
<tr>
<td>Research</td>
<td>TEES</td>
<td>$9,522,789.57</td>
</tr>
<tr>
<td>Gifts and Endowments</td>
<td>Faculty</td>
<td>$1,162,708.15</td>
</tr>
<tr>
<td>Gifts and Endowments</td>
<td>Scholarship</td>
<td>$838,971.25</td>
</tr>
<tr>
<td>Gifts and Endowments</td>
<td>Fellowship</td>
<td>$250,271.90</td>
</tr>
<tr>
<td>Gifts and Endowments</td>
<td>Research</td>
<td>$550,399.78</td>
</tr>
<tr>
<td>Gifts and Endowments</td>
<td>Department</td>
<td>$774,487.30</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$18,149,189.67</strong></td>
</tr>
</tbody>
</table>

At the end of FY13, the Department has endowments with a market value of $40.9 million that generate $1.7 million per year of income. This income was used to supplement salaries, to fund research endeavors of our faculty, and to provide financial assistance to both undergraduate and graduate students. Of the $40.9 million, $17.4 million funds chairs and professorships, $10.2 million funds scholarships, $0.83 million funds fellowships, $5.1 million funds the Crisman Institute for Petroleum Research, and $7.37 million funds special projects at the discretion of the department head. More than $10 million of additional gifts are currently pledged.
It can be concluded that the financial resources of the Department are adequate to meet the needs of our undergraduate program. The graduate program is also adequately funded; however, we have to solicit about $9 million per year of research funding to pay the summer salaries of our faculty and to pay for research assistantships.

**Endowed Chairs/Professorships**
The below tables show the endowed Chairs and Professorships the department currently has.

<table>
<thead>
<tr>
<th>Table 11. Endowed Chairs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Faculty Member</strong></td>
</tr>
<tr>
<td>Hisham Nasr-El-Din</td>
</tr>
<tr>
<td>Mike King</td>
</tr>
<tr>
<td>Dan Hill</td>
</tr>
<tr>
<td>Akhil Datta-Gupta</td>
</tr>
<tr>
<td>Christine Ehlig-Economides</td>
</tr>
<tr>
<td>Peter Valko</td>
</tr>
<tr>
<td>Maria Barrufet</td>
</tr>
<tr>
<td>NEW</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 12. Endowed Professorships</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Faculty Member</strong></td>
</tr>
<tr>
<td>Duane McVay</td>
</tr>
<tr>
<td>Ding Zhu</td>
</tr>
<tr>
<td>Tom Blasingame</td>
</tr>
<tr>
<td>Robert Wattenbarger</td>
</tr>
<tr>
<td>Vacant</td>
</tr>
<tr>
<td>John Killough</td>
</tr>
<tr>
<td>Vacant</td>
</tr>
<tr>
<td>Vacant</td>
</tr>
<tr>
<td>Pending</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

**Research Funding**
The success of any research program starts with writing quality research proposals. In 2013, we had 62 proposals submitted by our faculty totaling $23.3 million. Of these, 28 were awarded in 2013 totaling $6.9 million. 14 proposals were declined. The other 20 proposals totaling $12.2 million were still under review with many of them submitted to Federal agencies. We received 78 Research Awards in 2013 that totaled $9.3 million. This number is higher than the $6.9 million awarded based on proposals submitted through TEES, because there is considerable funding that we receive without any proposal being written. For example, all of the Crisman Institute funding comes in each year without a formal proposal being written. The sponsors came from both Government and Industry partners. The success of our Graduate Program is directly tied to our research success. Research funding goes to support our Graduate students through research assistantships and tuition support. The proposals submitted and awards received in the 2013 fiscal year are detailed in Appendix M.
Crisman Institute
The endowment and research income from the Crisman Institute are detailed in the table below.

<table>
<thead>
<tr>
<th>Company</th>
<th>Endowment</th>
<th>Est. Annual Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisman Institute</td>
<td>$2,318,416</td>
<td>$93,685</td>
</tr>
<tr>
<td>Chevron</td>
<td>956,223</td>
<td>78,640</td>
</tr>
<tr>
<td>Halliburton</td>
<td>938,761</td>
<td>77,934</td>
</tr>
<tr>
<td>Schlumberger</td>
<td>943,722</td>
<td>78,135</td>
</tr>
<tr>
<td>Anadarko</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>ARAMCO</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>Baker Hughes</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>BG Group</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>BP America</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>EMAROC</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>ENI-EPD</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>ESTATO</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>Hess Corp</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>KNOC</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>MI-SWACO</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>NEXEN</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>REPSOL</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>SEPC</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>TOTAL E&amp;P</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td>Woodside</td>
<td></td>
<td>90,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$5,057,122</strong></td>
<td><strong>$1,858,394</strong></td>
</tr>
</tbody>
</table>

Budgeting
The academic budget (State of Texas funding) for the department is determined by the Dean of the College of Engineering. It is basically constant from year to year with changes coming from the increase or decrease in the number of faculty. Faculty salaries and hiring decisions are approved by the Dean and the Provost upon recommendations from the Department Head and departmental faculty. The Department Head then decides how those funds are allocated in coordination with other available Departmental resources to meet the needs of the department. The department provides 9-months funding of faculty salaries and the faculty typically fund their 3-month summer salary out of their research projects – unless they accept a summer teaching assignment.

Facilities and Equipment
The department operates its own computer network, and maintains five computer classrooms for teaching and student support. We try to replace approximately one-third of the computers annually in these classrooms and workrooms to stay abreast of the latest technology. Part of the
funding for this comes from student fees and part comes from industry and individual gifts to the department. In the future, we will be working with industry partners to provide the department with money to totally upgrade our computer system. Our teaching laboratories are well equipped and are adequate to teach undergraduate laboratory courses. We are always looking for ways to improve the laboratories for both teaching and research.

Management and Leadership
The Department is organized and managed very efficiently. We track students as soon as they apply for admission to Texas A&M University. If they show a preference for Petroleum Engineering, we immediately contact them by email or phone. We have a network of former students who we can also use to contact each student and encourage them to attend Texas A&M University. These same former students are also helping the department by noticing students who excel in mathematics and science and recruiting them for Texas A&M University.

In the longer term, significant changes in the role of petroleum engineering can be expected. For the next few decades, it is obvious that oil and gas will power the world. However, at some point in time, other fuels will become important. We are beginning to look at how the department can keep its roots but also take a broader view in terms of Energy. We have hired new faculty and we believe we will attract new students who are interested in the general field of energy.
Equipment – Computer Facilities

University Computer Facilities
Computing and Information Services (CIS) of the University provides over one thousand computers in six open access labs (see below) that are available to Computer Science students, along with all other Texas A&M University students.

Supercomputing Facility
The University also maintains two supercomputers. EOS built in May of 2010 is an IBM iDataplex cluster which has 3168 cores [@2.8 GHz] and 9056GB of main memory. At peak performance it is capable of 35.5 TFlops. The system is configured with 500TB of disk space. The Lonestar cluster built in 2011 is a Dell platform Linux based cluster has 22656 cores [@3.3 GHz] and 44TB of main memory. At peak performance it can perform 302 TFlops. The system is configured with 276 TB of disk space. Students are allotted fifty CPU hours of supercomputer time per fiscal year.

Open Access Labs
Texas A&M University has five labs open to Ph.D. students: Blocker, Read, Student Computing Center, West Campus Library, and Wisenbaker.

- Blocker provides one hundred-seventy three computers and printing. This lab is typically open from 7:30am to midnight Monday through Thursday, 7:30am to 5pm on Friday, and closed Saturday and Sunday.
- Horticulture classroom provides thirty four computers and printing. This lab is typically open from 8am to 5pm Monday through Friday and closed Saturday and Sunday.
- Student Computing Center provides five hundred and fifty six computers, scanning, video editing, plotter, and printing services. This lab is typically open 24 hours a day Monday through Friday, and 1pm to 5pm on Saturday and Sunday.
- West Campus Library provides two hundred sixty nine computers, scanning, and printing services. This lab is typically open 24 hours a day Monday through Friday, and 1pm to 5pm on Saturday and Sunday.
- Zachary provides seventy computers and printing. This lab is typically open from 7:30am to 10pm Monday through Thursday, 7:30am to 5pm on Friday, and closed Saturday and Sunday.
- Virtual Open Access lab provides virtual desktops to students for computing. This lab is typically open 24 hours a day seven days a week, but closes for scheduled maintenance windows.

Networking
Wireless access is currently available in over 250 campus buildings. Current coverage does include the Joe C. Richardson Building which houses the Harold Vance Department of Petroleum Engineering. The University has several redundant connections providing Internet access and a Gigabit Ethernet network backbone.
Department Computer Facilities
The Department of Petroleum Engineering understands that technology changes quickly and in order to prepare tomorrow’s professionals for entry into industry the Department must keep up with technological changes. In order to keep pace with technology the computer support team constantly evaluates emerging technologies they feel may be useful as teaching aids for our classroom facilities.

The Petroleum Engineering Department maintains many of its own services, such as ADS, email, FTP, file store, web, license management, backup and recovery. Each student receives an account for these services with a specified amount of storage. The amount of storage is based on student classification.

In order to keep the teaching labs up to date, the microcomputers in the labs are replaced on a three-year cycle. Currently the Petroleum Engineering Department maintains five computer labs for the students. One hundred and fifty eight microcomputers in five teaching labs are available to Petroleum Engineering students 24/7 when these computers are not being used to teach courses. In addition, most graduate students are provided with office space and/or a microcomputer depending upon funding of their research project.

In 2012 the department added a high powered computing cluster for students to access. The Windows based HP cluster consists of 256 cores [@3.2GHz] and 768GB of main memory. The system is configured with 1TB of shared storage. The system is mainly used to for research by graduate students. It has been used to teach HPC computing classes.

The department licenses/provides access to specialized software for student use such as Schlumberger (Eclipse, Petrel, Intersect, Techlog, Merak, and PipeSim), Landmark (Nexus, VIP, and Engineer’s Dekstop), Kappa Engineering (Ecrin full suite and Emeraude), IHS (Kingdom, Que$tor, and Petra), CMG, Palisade, FracProPT, Geographix, TecPlot, and Mathematica. Numerous other software packages are available to the students and faculty. Computer Support is open between the hours of 8 a.m. – 8 p.m. Monday through Thursday and 8 a.m. -5 p.m. on Friday to assist with computer or printer related problems.

Sources of Funds for Computing Infrastructure
Two main student fees support the computing infrastructure of the Department of Petroleum Engineering. The below table shows, each fee, the amount charged most recently and any restrictions on its use.
Industry Board

The Petroleum Engineering Industry Board promotes the continuous improvement of the Harold Vance Department of Petroleum Engineering at Texas A&M University. Members serve on committees focusing on the undergraduate program, the graduate and research programs, outreach programs, former student programs, and development. Its members are nominated from a variety of sources and selected by the department head to serve three-year terms. The Industry Board holds formal meetings twice a year. There are currently 48 industry members, 1 department head, 1 staff member, and 2 development officers serving on the board.

Table 14. The list Industry Board Members.

<table>
<thead>
<tr>
<th>Name</th>
<th>Company Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathy Beladi</td>
<td>TAMU Petroleum Engineering Dept.</td>
</tr>
<tr>
<td>Secretary to the Industry Board</td>
<td></td>
</tr>
<tr>
<td>Senior Administrative Coordinator</td>
<td></td>
</tr>
<tr>
<td>Greg Bird '82</td>
<td>Jetta Operating Co., Inc.</td>
</tr>
<tr>
<td>Industry Board Co-Chair</td>
<td></td>
</tr>
<tr>
<td>President</td>
<td></td>
</tr>
<tr>
<td>Elizabeth J. Cantrell '96</td>
<td>Kerns Petroleum Inc.</td>
</tr>
<tr>
<td>President and CEO</td>
<td></td>
</tr>
<tr>
<td>Clay Carrell '88</td>
<td>EP Energy</td>
</tr>
<tr>
<td>Executive Vice President, COO</td>
<td></td>
</tr>
<tr>
<td>Craig Clark '79</td>
<td>Wishbone Energy</td>
</tr>
<tr>
<td>President, CEO</td>
<td></td>
</tr>
<tr>
<td>Jeff Coburn '82</td>
<td>Halliburton</td>
</tr>
<tr>
<td>Region Cement Manager, Northern US/Canada</td>
<td></td>
</tr>
<tr>
<td>Robert Coffman '81</td>
<td>ConocoPhillips</td>
</tr>
<tr>
<td>Career Development Manager</td>
<td></td>
</tr>
<tr>
<td>Andrew Coleman '94</td>
<td>Raymond James &amp; Associates</td>
</tr>
<tr>
<td>Managing Director E&amp;P Research</td>
<td></td>
</tr>
<tr>
<td>J. Ross Craft '80</td>
<td>Approach Resources Inc.</td>
</tr>
<tr>
<td>President and CEO</td>
<td></td>
</tr>
<tr>
<td>William Deupree '83</td>
<td>Escondido Resources II, LLC</td>
</tr>
<tr>
<td>President and CEO</td>
<td></td>
</tr>
<tr>
<td>Derek Dictson '00</td>
<td>College of Engineering Development Office</td>
</tr>
<tr>
<td>Name</td>
<td>Company Name</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>David Dunlap '83</td>
<td>Superior Energy Services</td>
</tr>
<tr>
<td>CEO</td>
<td></td>
</tr>
<tr>
<td>David Dunton '85</td>
<td>Alpine Gas Company</td>
</tr>
<tr>
<td>Principal</td>
<td></td>
</tr>
<tr>
<td>Jeff Elkin '80</td>
<td>Empresa Energy</td>
</tr>
<tr>
<td>President and COO</td>
<td></td>
</tr>
<tr>
<td>Mark E. Ellis '79</td>
<td>LINN Energy, LLC</td>
</tr>
<tr>
<td>President and CEO</td>
<td></td>
</tr>
<tr>
<td>Tim Friesenhahn '86</td>
<td>XTO Energy Inc.</td>
</tr>
<tr>
<td>Vice President - Permian Division</td>
<td></td>
</tr>
<tr>
<td>Erin Gage</td>
<td>College of Engineering Development Office</td>
</tr>
<tr>
<td>Industry Board Development Officer</td>
<td></td>
</tr>
<tr>
<td>Assistant Director of Development</td>
<td></td>
</tr>
<tr>
<td>Terry Gerhart '84</td>
<td>Noble Energy</td>
</tr>
<tr>
<td>Vice President - International</td>
<td></td>
</tr>
<tr>
<td>Bill Gillespie '80</td>
<td>Marathon Oil Corp.</td>
</tr>
<tr>
<td>Manager Eagle Ford Business Development</td>
<td></td>
</tr>
<tr>
<td>Frosty Gilliam, Jr. '80</td>
<td>Aghorn Energy, Inc.</td>
</tr>
<tr>
<td>President</td>
<td></td>
</tr>
<tr>
<td>Dan Hill '74</td>
<td>TAMU Petroleum Engineering Dept.</td>
</tr>
<tr>
<td>Ex-Officio Member</td>
<td></td>
</tr>
<tr>
<td>Department Head</td>
<td></td>
</tr>
<tr>
<td>John H Hollowell '79</td>
<td>Shell Energy Resources Co.</td>
</tr>
<tr>
<td>Executive Vice President/Deep Water</td>
<td></td>
</tr>
<tr>
<td>Jeff Honeck '82</td>
<td>Estancia Oil &amp; Gas LLC</td>
</tr>
<tr>
<td>President</td>
<td></td>
</tr>
<tr>
<td>Steve Horn '79</td>
<td>CRS Proppants, LLC</td>
</tr>
<tr>
<td>Vice President</td>
<td></td>
</tr>
<tr>
<td>Mark Houser '83</td>
<td>EnerVest, Ltd.</td>
</tr>
<tr>
<td>Industry Board Co-Chair</td>
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</tr>
<tr>
<td>Executive Vice President and COO</td>
<td></td>
</tr>
<tr>
<td>Ramona Hovey '89</td>
<td>DrillingInfo, Inc.</td>
</tr>
<tr>
<td>Director, Project Management</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Company Name</td>
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<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------</td>
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<tr>
<td><strong>Peter D. Huddleston '80</strong></td>
<td>Huddleston &amp; Co., Inc.</td>
</tr>
<tr>
<td>President</td>
<td></td>
</tr>
<tr>
<td><strong>A. Carl Isaac '87</strong></td>
<td>Crimson Exploration Inc.</td>
</tr>
<tr>
<td>Senior Vice President, Operations</td>
<td></td>
</tr>
<tr>
<td><strong>Janeen Judah '81</strong></td>
<td>Chevron Africa and Latin America E&amp;P</td>
</tr>
<tr>
<td>General Manager - Houston &amp; Gas Assets</td>
<td></td>
</tr>
<tr>
<td><strong>Karl Kurz '83</strong></td>
<td></td>
</tr>
<tr>
<td>Independent Investor</td>
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</tr>
<tr>
<td><strong>Ted Lafferty '92</strong></td>
<td>Schlumberger</td>
</tr>
<tr>
<td>Vice President Stimulation</td>
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</tr>
<tr>
<td><strong>Trent Latshaw '75</strong></td>
<td>Latshaw Drilling &amp; Exploration Co.</td>
</tr>
<tr>
<td>President/Owner</td>
<td></td>
</tr>
<tr>
<td><strong>Jeff Lehrmann '86</strong></td>
<td>Chevron Canada Resources</td>
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<tr>
<td>President</td>
<td></td>
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<tr>
<td><strong>Richard Lonquist '87</strong></td>
<td>Lonquist &amp; Co.</td>
</tr>
<tr>
<td>President</td>
<td></td>
</tr>
<tr>
<td><strong>Donald Lovingfoss '87</strong></td>
<td>Lovingfoss Energy</td>
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<tr>
<td>President</td>
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<tr>
<td><strong>Jeffrey W. Miller '85</strong></td>
<td>Vortus Investments</td>
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<td>Managing Partner</td>
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<td><strong>Stephen Miller '79</strong></td>
<td>Chesapeake Energy Corp.</td>
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<tr>
<td>Senior Vice President, Drilling</td>
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<tr>
<td><strong>Rick Moncrief '81</strong></td>
<td>Caiman Energy, LLC</td>
</tr>
<tr>
<td>President &amp; COO</td>
<td></td>
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<tr>
<td><strong>Richard Morrison '80</strong></td>
<td>BP America Production</td>
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<tr>
<td>Vice President, Global Deepwater</td>
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<tr>
<td><strong>Gene Narahara '81</strong></td>
<td>Chevron ETC</td>
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<td>Reservoir &amp; Production Engineer</td>
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<tr>
<td><strong>Karen Olson '87</strong></td>
<td>Southwestern Energy</td>
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<tr>
<td>Director V+ Solutions</td>
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<tr>
<td><strong>Douglas B. Otten '65</strong></td>
<td>Nexen Petroleum USA Inc.</td>
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<td>Retired - President</td>
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<td>Name</td>
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<tr>
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<tr>
<td>David Pursell '85</td>
<td>Tudor, Pickering, Holt &amp; Co Securities Inc.</td>
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<td>Managing Director - Head of Macro Research</td>
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<td>Terry Rathert '75</td>
<td>Newfield Exploration Company</td>
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<tr>
<td>Executive Vice President and CFO</td>
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<tr>
<td>Lance Robertson '98</td>
<td>Marathon Oil Corp</td>
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<tr>
<td>Vice President, North America Production Operations</td>
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<td>Mark Rubin '81</td>
<td>Society of Petroleum Engineers</td>
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<td>Executive Director</td>
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<tr>
<td>John D. Schiller, Jr. '81</td>
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<tr>
<td>Chairman and CEO</td>
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<tr>
<td>Ken Sheffield '82</td>
<td>Pioneer Natural Resources</td>
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<td>Senior Vice President, Operations &amp; Engineering</td>
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<tr>
<td>Catherine Sliva '80</td>
<td>BlueRock Energy Capital</td>
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<td>Industry Board Vice Chair</td>
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<td>George Voneiff '83</td>
<td>Unconventional Gas Resources</td>
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<tr>
<td>President &amp; CEO - UGR US</td>
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<tr>
<td>Joe Wright '82</td>
<td>COG Operating LLC</td>
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<tr>
<td>Executive Vice President and COO</td>
<td></td>
</tr>
<tr>
<td>Clifford Zwahlen '87</td>
<td>Midstates Petroleum Company, Inc.</td>
</tr>
<tr>
<td>Vice President of Reservoir Engineering</td>
<td></td>
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</table>
Petroleum Engineering 25 by 25 Growth Plan

Overview
The COE provided guidelines regarding the desired growth of undergraduate and graduate population for the COE, not for individual departments. Suggested annual growth rates were provided for the different degree categories. This results in more than doubling the number of students in 12 years.

Any growth model must take into account adequate career placement for our graduates. The job market for Petroleum Engineering has been traditionally cyclic (boom and bust), and we must factor in this uncertainty. There is concern from some indicators (such as internships, historical trends, and placement) that the demand for Petroleum Engineers may slow down or perhaps decline. Other sources provide a more optimistic perspective considering the new job opportunities given by unconventional resources development, such as tight oil and shale gas, offshore operations and retirement of baby boomers. This report details our plans for growth in undergraduate student population, in M.S. and Ph.D. student numbers, in M. Eng. Population, and in the corresponding needs for increased faculty and staff. We also discuss pedagogical changes being planned or already implemented to effectively and efficiently instruct a growing student body.

Undergraduate
The anticipated petroleum engineering undergraduate enrollment is shown in Fig. 1. Assuming that the U.S. petroleum industry remains robust in the future, we are planning a modest growth of about 20 students per year beginning in 3 years. The fall 2013 petroleum engineering undergraduate enrollment is 812 students, so we are already slightly ahead of this schedule. Fig. 1 also shows a possible declining undergraduate enrollment, beginning in 2016. This is a reflection of the potential for a significant weakening of the petroleum engineering job market for B.S. graduates. Undergraduate enrollments and graduation rates in U.S. petroleum engineering departments are at historical highs and are still climbing rapidly. For example, freshman enrollment increased by 55% in 2012 over 2011. It appears that at some time in the not too distant future, the supply of B.S. petroleum engineering graduates in the U.S. will exceed the demand. When the petroleum engineering job market weakened dramatically in the 80’s, undergraduate enrollment in our department plummeted by almost 90%, from over 1700 to less than 200 in a 4 year period. We are positioning ourselves to avoid such a decline by moderating our undergraduate growth. We are also making it clear to recruiters that we are maintaining sufficient student population control to insure that our graduates have received a high quality education, in contrast to some departments around the country who are facing uncontrolled growth with very small faculty numbers. If a job downturn occurs, we want our graduates to be hired first, before companies turn to lower quality programs. A recent article by Hill and Holditch [2013] gives more detail about anticipated U.S. B.S. petroleum engineering supply and demand.
M.S. and Ph.D.

We are planning a steady growth rate of 10 M.S. and 10 Ph.D. students per year, resulting in a population of 270 M.S. and 220 Ph.D. students by 2025 (Fig. 2). These students need to be supported by external research funds and supervised by tenured/tenure track faculty. We are planning to add 2 tenured/tenure track faculty per year to handle the increasing numbers of M.S. and Ph.D. students. The planned research grad student/faculty ration of 10 is a heavy load, but it is less than the current load of over 12 grad students per faculty.

We do not have the same job market concern for M.S. and Ph.D. graduates as for B.S. graduates. Interestingly, during the weak market for B.S. graduates from 1984 to the early 2000’s, grad enrollments and job placement was stable. Our industry also seems to be placing more value on the M.S. degree, with the current hiring being very robust and salaries high. Finally, though we are planning substantial growth in the Ph.D. population that has already grown several-fold in the past ten years, the supply of petroleum engineering Ph.Ds. from top programs will remain very limited.

The primary restraint on growth at the M.S. and Ph.D. level will be our ability to grow the tenured/tenure-track faculty at the planned net rate of 2/year. With anticipated retirements, this will require us to hire new faculty at a rate nearer to 3/year. This is a challenging, but doable task. We do not feel constrained by a lack of qualified students to fuel the planned growth, as we are currently accepting only about 15% of the applicants to our graduate program. We have also initiated a graduate student recruiting campaign aimed at increasing the fraction of domestic students in our graduate program, and this will help us to keep up with the planned growth, while improving student quality.
M.Eng.

We are planning our most significant growth in our Distance Learning (DL) M.Eng. program, with planned growth rate between 5 and 10% per year (Fig. 3). The number of B.S. petroleum engineering graduates has been growing steadily for over ten years, creating a large population of potential M.Eng. DL students. In addition, the oil and gas industry has hired large numbers of engineers of other disciplines into the upstream business, and these young engineers are also a source for the Distance Learning population. The students currently in our program see a lot of value in it and are our best ambassadors for growing the program. We have a very well-run and staffed distance learning program so it should continue to grow in our offerings of traditional petroleum engineering subjects.

Additional growth in our M.Eng. DL population will come from our participation in new, multidisciplinary degree and/or certificate programs being planned such as the subsea engineering program. We plan to use our existing DL infrastructure to facilitate the growth of such programs.

The anticipated enrollments at all degree levels by 2018 and 2025 are shown in Table 15.
Faculty and Staff Growth

As mentioned previously, we plan to add a net of 2 tenured/tenure-track faculty per year throughout the planning period. These increases are required to handle the planned increase in M.S. and Ph.D. enrollments. However, we will need additional non-tenured faculty to bring down currently excessive student/faculty ratios, and to handle the increasing numbers of M.Eng. students. We are planning to
add a net of 2 non-tenured faculty per year.
The increasing number of faculty and students will require an increase in the number of supporting
staff. Our planned increases in faculty and various staff functions is shown in Table 16. The planned
growth in staff is at a substantially lower rate than the planned faculty growth.

Table 16. Faculty and Staff Growth Plan

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<thead>
<tr>
<th>Status</th>
<th>2013</th>
<th>2018</th>
<th>2025</th>
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<tr>
<td>Tenured/Tenure-track faculty</td>
<td>21</td>
<td>31</td>
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<tr>
<td>Non-tenured faculty</td>
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<td>23</td>
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<tr>
<td>Advising staff</td>
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<td>5</td>
<td>6</td>
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<td>Technicians</td>
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<tr>
<td>Accounting</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Administrative staff</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Specific creative instruction plans
The exponential growth experienced by the PETE department during the last 12 years has forced our
faculty to find efficient modes of instruction. We already have been implementing most of the
proposed initiatives regarding ‘flipped instruction’ and extensive use of technology. We surveyed our
faculty to determine current or planned practices for efficient instruction of large classes. Overall
these techniques could be summarized in the following bullets.
• Hybrid/flipped courses (+ online materials)
• Flexible recitation times
• Open ended problems (assess uncertainty and risk)
• Collaborative / Cooperative Learning (design courses)
• Use of social networking tools (Facebook, blogs, LMS digital board, Skype)
• Games/simulations/virtual labs (jigsaw)
• Knowledge-based competitions and reward system (student paper contest, Petro-bowl)
• Use of clickers (instant feedback and on-the-spot remediation)
• Coach/mentoring (rotational group leaders, peer assessment)
• Online tutorials (mock exams)

High impact learning opportunities and resources
Beginning Fall 2013, all faculty will have the option of having their undergraduate classes recorded
and made available to students using the ECHO technology system used for our distance learning
program. Due to the large overall growth anticipated at all levels, Distance learning program funds
have been invested in purchasing a 5K ECHO site license. This provides more capacity and
opportunities to flip courses. We are currently evaluating virtual desktop environment infrastructure
(VDI) with technical software used in the department (CMG, Eclipse, Petrel, etc.).

Reference
2013.
Name: Yucel Akkutlu  

Academic Rank: Associate Professor (full time)

Degrees:  
Ph.D. Petroleum Engineering, University of Southern California at Los Angeles, 2002  
M.S. Petroleum Engineering, University of Southern California at Los Angeles, 1995  
B.S. Chemical Engineering, Hacettepe University at Ankara, Turkey, 1992

Professional experience:

Texas A&M University, College Station, USA  
Harold Vance Department of Petroleum Engineering  
January 1, 2013-present, tenured associate professor of petroleum engineering

University of Oklahoma, Norman, USA  
Mewbourne School of Petroleum and Geological Engineering, MPGE  
July 1, 2011-December 2012, tenured associate professor of petroleum engineering  
July 1, 2007 – June 30, 2011, assistant professor of petroleum engineering

University of Alberta, Edmonton, Canada  
School of Mining and Petroleum Engineering  
Civil and Environmental Engineering Department  
April 1, 2004 – July 1, 2007, assistant professor of petroleum engineering

National Institute of Pure and Applied Mathematics (IMPA), Rio de Janeiro, Brazil  
Fluid Dynamics Laboratory  
May 19 – August 30, 2002, visiting scholar, Reaction wave sequences in porous media

University of Southern California, Los Angeles, USA  
Chemical Engineering Department  
1994 – 2002, Graduate research assistant

Undergraduate and Graduate Courses Taught:  
PETE 311 Reservoir Petrophysics; PETE 632 Physical and Engineering Properties of Rock

Selected Publications:


Journal articles: 22  
Patents: 1  
Reports, Books and Book Chapters: 6  
Conference Proceedings: 29

**Scientific and Professional Society Membership/Offices:**
Member of the Society of Petroleum Engineers SPE, American Inst. of Chemical Engineers AIChE

**Recent Honors and Awards:**
- George and Joan Voneiff Unconventional Resources Development Professorship, 2014
- SPE Distinguished Lecturer, 2014-15
- SPE “A Peer Apart” Honorary Award, 2012
- SPE Mid-Continent North America Region Faculty Travel Award, 2010
- SPE Outstanding Service Award, 2010
- SPE Outstanding Service Award, 2009
- SPE Outstanding Service Award, 2008
- University of Southern California, School of Engineering Outstanding Service Award, 1997
- Petroleum Engineering Honor Society, ΠΕΤ, Distinguished Service Award, 1996
- University of Southern California, Jackling Engineering Award, 1994
- Woodruff Petroleum Scholarship, 1994
- Kallam-Floyd Petroleum Engineering Grant, 1994

**Other Recent Professional Activities:**
**Service:**
- Executive Editor, SPE Journal, 2012-present
- Associate Editor, SPE Journal, 2007-2012
- Committee Chair, Natural Science and Engineering Research Council of Canada (NSERC) materials and chemical engineering committee
- Texas A&M University Disciplinary Appeals Panel October 2013-October 2015;

**Industry Short Courses:**
- Applied Petroleum Engineering and Reservoir Simulation
- Enhanced Oil Recovery: Techniques, Practices and Simulation
- Reservoir Engineering for Shale Gas and Oil Resources
Name: Walter B. Ayers, Ph.D., CPG  Academic Rank: Visiting Professor (full time)

Degrees:  Ph.D., Geology, The University of Texas at Austin, 1984  
          M.S., Geology, West Virginia University, 1971  
          B.S., Geology, West Virginia University, 1969

Professional Experience:  
Texas A&M University, College Station, TX, USA  
Harold Vance Department of Petroleum Engineering, Visiting professor  
Department of Geology and Geophysics, Adjunct Professor  
January 2001–present

Schlumberger Holditch Reservoir Technologies, College Station, Tx, USA  
Principal Consultant, June 1999–2001

S. A. Holditch & Associates, Inc., College Station, Tx, USA  
Vice President, Geosciences  
November 1995–1999

Taurus Exploration, Inc. / Energen Resources, Birmingham, AL, USA  
General Manager, Geology, 1994–1995  
Manager, Geology, 1993–1994  
Senior Geologist, 1991–1993

The University of Texas at Austin, Bureau of Economic Geology, Austin, TX, USA  
Program Coordinator, Gas and Coal Resources Research, 1989–1991  
Research Associate, 1984-1988  
Research Assistant, 1979–1984

Tidewater Community College, Virginia Beach, VA, USA  
Assistant Professor, geology, chemistry and environmental science 1978-1979  
Instructor, geology, chemistry and environmental science, 1971-1978

Winthrop University, Rock Hill, South Carolina, USA  
Instructor, September 1971– August 1972

United States Air Force, Plattsburgh AFB, NY. USA  
Medical Radiologic Technologist, 1961–1965

Undergraduate and Graduate Courses Taught:  
PETE 311, Reservoir Petrophysics; PETE 321, Formation Evaluation, PETE 400, Reservoir Description; GEOL 404, Geology for Petroleum Engineers; PETE 612, Unconventional Oil and Gas Reservoirs; PETE 663, Formation Evaluation and the Analysis of Reservoir Performance; PETE 644, CO₂ Capture and Uses: Sequestration, Enhanced Oil Recovery (EOR)
Selected Publications:

Books: 1
Book Chapters: 25
Journal Articles: 18
Conference Papers: 72
Invited Lecturers: 75

Scientific and Professional Society Membership/Offices:

Other Recent Professional Activities:
Service:
Tectonics/Basin Analysis Faculty Search Committee, Geology and Geophysics Dept., 2013-14.
Reflection Seismologist Faculty Search Committee, Geology and Geophysics Dept., 2012-13.

Industry Short Courses:
Introduction to Unconventional Oil and Gas Reservoirs (Coalbed Methane, Shale Oil and Gas, and Tight Sands) (5-day course)
Introduction to Shale Oil and Gas Reservoirs (2-day course)
Introduction to Coalbed Methane (3-day course)
Petroleum Geology for Engineers (5-day course)
Petroleum Geology for Non-Technical Professionals (5-day course)
Name: Maria A. Barrufet  Academic Rank: Professor (full time)

Dean Fellow for Innovation in Distance Learning (2012-2013)
Baker Hughes Endowed Chair of Petroleum Engineering, Adjunct Professor of Chemical Engineering

EDUCATION
• Ph.D. Chemical Engineering: Texas A&M University, College Station, TX  December, 1987.
• B.S (Chemical Engineer): Universidad Nacional de Salta, Salta, Argentina. May, 1979.

RESEARCH INTERESTS
• Electron Beam Upgrading of Heavy Oil and Radiation Thermal Cracking

LATEST PROFESSIONAL EXPERIENCE
2006 – present – Director Distance Learning Program – Petroleum Engineering Department (Texas A&M University)
2006 – 2013 – Assistant Department Head for Administration- Petroleum Engineering Department (Texas A&M University)
September 2007 – present – Adjunct Professor Chemical Engineering Department, Texas A&M University. September 2004 – present – Professor Petroleum Engineering Department, Texas A&M University.

RECENT UNDERGRADUATE AND GRADUATE COURSES TAUGHT

Selected Publications


10. Valbuena E., and Maria Barrufet “A generalized partial molar volume algorithm provides fast estimates of CO2 storage capacity in depleted oil and gas reservoirs” Fluid Phase Equilibria, Vol 359, pp45-532013


Peer reviewed publications 7, b) Conference proceedings 90+, c) Invited Lectures/Presentations , d) Books and Book Chapters 2, f)Invited Lectures/Presentations 20+

Other Recent Professional Activities Industrial/Consulting
- Awards and Society Memberships
- Member of SPE (Society of Petroleum Engineers).
- Elected SPE Distinguished Member 2013
- Charles Crawford Service Award (2012)

Professional Service
- Chair Session “Produced Water Management” LACPEC 2009 SPE Cartagena

Recent University and Community Service
- Chair College Level Growth Committee (2013-current)
- Member of Academic Civil Rights Investigation Committee (ACRIC) (2012-current)
- Member of Search Committee for Faculty in Chemical Engineering (2013-current)
- Chair Faculty Search Committee for Petroleum Engineering (2013-current)
- Departmental representative for College Level Tenure and Promotion Committee (2011-2013)

Current Number of Students Chaired
During the last 5 years I collaborated with 176 students as a member of chair in their degree plans (mostly DL). From these 176 I was or I am still the chair or co-chair of 57. I graduated 12 MENG (chair), 7 MENG (co-chair), 3 MS chair, 1 MS co-chair, 2 PhD chair. The rest are in progress mostly MENG (DL). Currently supervise 4 PhD’s and 6 MS’s.
Name: Thomas A. Blasingame, P.E.  

Academic Rank: Professor (part-time)

Degrees:  
- Ph.D. Petroleum Engineering, Texas A&M University, 1989  
- M.S. Petroleum Engineering, Texas A&M University, 1986  
- B.S. Chemical Engineering, Texas A&M University, 1984

Professional Experience:  
- 2005: Professor, Dept. of Petroleum Eng., Texas A&M U.  
- 1996 - 2005: Associate Professor, Dept. of Petroleum Eng., Texas A&M U.  
- 1984 - 1989: Graduate Assistant, Dept. of Petroleum Eng., Texas A&M U.

Undergraduate and Graduate Courses Taught: (last 5 years)  
- PETE 620 Fluid Flow in Petroleum Reservoirs  
- PETE 631 Petroleum Reservoir Description  
- PETE 663 Formation Evaluation and the Analysis of Reservoir Performance

Selected Publications:  

Journal articles: 18  
Conference Papers: 113

Scientific and Professional Society Membership/Offices:  
- Associate Member, American Association of Petroleum Geologists (AAPG)  
- Member, American Institute of Chemical Engineers (AIChE)  
- Member, American Society for Engineering Education (ASEE)  
- Member, Society of Exploration Geophysicists (SEG)  
- Member, Society of Petroleum Engineers (SPE)  
- Registered Professional Engineer, Texas (77391)
Recent Honors and Awards: (last 10 years)

- 2004 "Fish Camp" Blasingame (University freshmen orientation group) - Texas A&M U.
- 2004 John J. Koldus Faculty/Staff Achievement Award - Texas A&M U. (*highest service award*)
- 2005 SPE Distinguished Service Award, Soc. of Petro. Engineers (SPE)
- 2005 SPE Distinguished Lecturer, Soc. of Petro. Engineers (SPE)
- 2006 SPE Uren Award, Soc. of Petro. Engineers (SPE). (*technology contributions before age 45*)
- 2006 Distinguished Achievement (Teaching) Award, Assoc. of Former Students - Texas A&M U.
- 2007 Charles W. Crawford Service Award — College of Engineering/Texas A&M U.
- 2011 SPE Gulf Coast Dist. Achievement for Petroleum Eng. Faculty, Soc. of Petro. Eng. (SPE)
- 2012 "Texas Top Producers" (Petroleum Engineer) TX Ind. Prod. & Royalty Owners Assoc. (TIPRO)
- 2012 SPE Lucas Award, Soc. of Petro. Engineers (SPE). (*SPE's preeminent technical award*)
- 2013 SPE DeGolyer Dist. Service Medal, Soc. of Petro. Engineers (SPE). (*SPE's highest service award*)

Other Recent Professional Activities:

Service: (last 5 years)

SPE Service: (only conference chair/co-chair cases are shown)

- 2009 SPE ATW, *Continuous Reservoir Monitoring* (Kota Kinabalu, Malaysia)
- 2009 SPE International Conference on CO2 Capture, Storage, and Utilization (San Diego, CA, USA).
- 2010 SPE Unconventional Gas Conference (Pittsburgh, PA, USA).
- 2011 SPE Unconventional Gas Conference (The Woodlands, TX, USA).
- 2012 SPE Unconventional Resources Conference — USA (Pittsburgh, PA, USA).
- 2013 SPE Unconventional Resources Conference — USA (The Woodlands, TX, USA).
- 2013 SPE Unconventional Resources Conference & Exhibition (Asia-Pacific) (Brisbane, Australia).
- 2014 SPE Unconventional Resources Conference — USA (The Woodlands, TX, USA).

SPE Reservoir Description & Dynamics (RD&D) Advisory Committee (2012-2015)

Other Service:

- Texas A&M (College of Engineering) — Strategic Planning Committee (2007-2011)

Industry Short Courses: (last 5 years)

- 2010 Dec U.Tulsa/DOE/PTTC Tulsa, OK (USA) Reserves/Unconventional Res.
- 2010 Jul U.Tulsa/DOE/PTTC Tulsa, OK (USA) Reserves/Unconventional Res.
- 2009 Jun Statoil Oslo, Norway Performance Analysis (Theory)
- 2009 May Bauerberg Consultants Neuquen, Argentina Tight Gas Reservoirs
Name: Akhil Datta-Gupta, P.E.  

Academic Rank: Professor (part-time)

Education
- Ph. D Petroleum Engineering, University of Texas at Austin (1992).
- M.S. Petroleum Engineering, University of Texas at Austin (1985).
- B.S. Petroleum Engineering, Indian School of Mines, Dhanbad, India (1982)

Professional Experience

Academic Positions
- Regents Professor and holder of L.F. Peterson ’36 Endowed Chair in Petroleum Engineering, Texas A&M University (2011- Present)
- Professor and Holder of LeSuer Chair in Reservoir Management, Petroleum Engineering, Texas A&M University, College Station, TX (July 05 - 2011)
- Professor and Holder of Rob L. Adams Professorship in Petroleum Engineering, Texas A&M University, College Station, TX (from Sept. 03- June 05)
- Associate Professor and Holder of Rob L. Adams Professorship in Petroleum Engineering, Texas A&M University, College Station, TX (Sept. 00 to Sept. 03)
- Assistant Professor, Petroleum Engineering, Texas A&M University, College Station, TX (Sept. 94 to Sept. 00)

Industrial/National Laboratory Positions
- Staff Scientist II, Reservoir Engineering and Hydrogeology Group, Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA (Dec. 92 to Sept. 94).
- Engineering Specialist, Fluid Flow Unit, BP Research, Cleveland (Jul. 89 to Aug.90.)
- Reservoir Engineer, BP Exploration, Alaska (previously Standard Oil) (Oct. 85 to Jul. 89.)

Honors/Awards
- Member, National Academy of Engineering (elected, 2012)
- Member, The Academy of Medicine, Engineering and Science of Texas (inducted, 2012)
- BP Teaching Excellence Award, Texas A&M University (2012).
- Regents Professor Award for exemplary performance (2011-Present).
- John Franklin Carll Award for distinguished contribution in engineering (2009)
- Outstanding Contributions to Basic Research in Geosciences, U.S. DOE BES (2008)
- Texas Engineering Experiment Station (TEES) Fellow, Texas A&M University (2007)
- Lester C. Uren Award for distinguished achievement in petroleum technology, (2003)
- Distinguished Member, Society of Petroleum Engineers (elected, 2001)
- Distinguished Lecturer, Society of Petroleum Engineers (1999-2000).
- Tenneco Meritorious Teaching Award, Texas A&M University (1997).

Professional Society Membership
- Distinguished Member, Society of Petroleum Engineers (SPE)
- Board Member, SPE Gulf Coast Section (over 10,000 members) (2000-2002).
- Member, American Geophysical Union (AGU)

Professional Services
• Chair, Carll, Lucas and Uren Award Committee (the highest technical awards), Society of Petroleum Engineers (2014)
• Member, Carll, Lucas and Uren Award Committee, Society of Petroleum Engineers (2013)
• Co-chair, SPE Advanced Technology Workshop on History Matching, Cartagena, Colombia (2011)
• Member, Technical Program Committee, SPE Reservoir Simulation Conference, Houston (2011)
• Member, SPE/OTRC Committee to Develop Guidelines for Worst Case Discharge Calculations for Offshore Drilling Permits (2010)

Research (Active Funded Projects)
• Model Calibration and Efficient Reservoir Imaging: A Joint Industry Project. Multiple Domestic and International Oil and service Companies. Project Duration Nov. 2004- Present.

Publications
Books

Peer-reviewed Journal Articles (Five Recent, Total over 90)

Graduate Courses Taught
Data Integration (PETE 633), Streamline Simulation (PETE637), Geostatistics (PET630)
Name: Fred E. Dupriest, P.E.  Academic Rank: Professor of Engineering Practices (part time)

Degrees: B.S. Mechanical Engineering, Texas A&M University, College Station Tx, 1977

Professional experience:
Texas A&M University
2013-2014 Harold Vance Department of Petroleum Engineering, Professor of Engineering Practices

ExxonMobil
2010-2012 Chief Drilling Engineer, Houston
2008-2010 Senior Consultant, Drilling Technical, Houston
1999-2008 Senior Advisor, Drilling Technical, Houston
1995-1997 Staff Engineer, New Orleans Drilling
1989-1995 Senior Staff Engineer, Houston Drilling
1985-1989 Exploration/Drilling Liaison, Houston Exploration
1983-1985 Drilling Engineering Manager, Esso Suez Inc., Cairo, Egypt
1982-1983 Senior Engineer, Exxon-Aramco Secondee, Ras Tanura, Saudi Arabia
1980-1982 Drilling Engineering Supervisor, Houston Drilling
1979-1980 Drilling Engineer, Houston Drilling
1978-1979 Production Engineer, Hydraulic Stimulation Design, Tyler
1978-1978 District Corrosion Engineer, Tyler
1977-1978 Subsurface Engineer, Workovers, Tyler

Selected Publications:
5. Use of New Hydrostatic Packer Concept to Manage Lost Returns, Well Control, and Cement Placement in Field Operations, F.E. Dupriest, ExxonMobil Development Company, SPE 112657 presented at SPE/IADC Drilling Conference, Orlando, Florida, USA, 4-6 March 2008

Journal articles: 20
Peer reviewed publications: 6
Patents: 2
Scientific and Professional Society Membership/Offices:
Society of Petroleum Engineers SPE, American Association of Drilling Engineers AADE

Recent Honors and Awards:
2013 SPE Drilling Engineering Award
2010 AADE Drilling Fluids Hall of Fame Inductee

Other Recent Professional Activities:
Service:
2010 Joint Industry Task Force, Horizon Blowout Response
2010 API RP 96 Deepwater Practices, Section Lead
2010 SPE Lost Circulation Forum, Organizing Committee
2012 SPE Lost Circulation ATW Organizing Committee
2014 SPE Well Efficiency Forum Organizing Committee
2012-2014 Technical presentations at Houston AADE, Lafayette AADE, Houston AADD, Houston SPE, Univ. of Texas AADE, and A&M AADE chapter meetings

Industry Short Courses Taught:
2012 High Performance Drilling, Sandia National Laboratories
2012 High Performance Drilling, B.B.S Russia/Kazakhstan
Name: Christine A. Ehlig-Economides  

Academic Rank: Professor (full time)

Degrees:  
Ph.D. Petroleum Engineering, Stanford University, 1979  
M.S. Chemical Engineering, University of Kansas, 1976  
M.A.T. Mathematics Education, University of Kansas, 1974  
B.S. Math-Science, cum laude, Rice University, 1971

Professional experience:  
2004-present  Professor and Albert B. Stevens Endowed Chair, Harold Vance Department of Petroleum Engineering, Texas A&M University  
2003-04  Professor, Chemical Engineering Dept., University of Houston  
2000-03  Adjunct Professor, Chemical Engineering, University of Houston  
1983-2003  Various Positions, Various Locations, Schlumberger  
1981-83  Department Head, Petroleum Engineering, University of Alaska, Fairbanks

Undergraduate and Graduate Courses Taught:  
PETE 648 Pressure Transient Testing  
PETE 689 Energy and Sustainability  
ENGR 101 Energy Engineering

Major Research  
Shale Gas  
Initial project funded by DOE on New Albany Shale yielded 2 papers, one on well design and one on well analysis  
Continued research using Horn River, Haynesville, and Fayetteville shale data with funding from TAMU Crisman Institute, Schlumberger, and Economides Consultants yielded 2 papers on integrated studies and 3 in preparation including one on DFIT analysis, one on fracture treatment modeling, and one on stress dependent permeability

Deepwater  
Funded by Chevron using data from Chevron and from Noble Energy yielded 4 papers

CO₂ Storage  
Chair funded work that yielded 5 papers related to pressurization during aquifer injection, injection falloff behavior, and field study of CO₂-brine displacement in the Woodbine aquifer

Solar H₂ Generation

Selected Publications:  
production from water/methanol decomposition using Ag/TiO2 nanocomposite thin films,”


Books: 2
Journal articles: 27
Patents: 2
Conference Papers: 61

**Scientific and Professional Society Membership/Offices:**
- Member of Society of Petroleum Engineers of AIME
- Member of American Association of Petroleum Geologists
- Member of American Society for Engineering Education
- Member of NRC Board on Energy and Environmental Systems, 2010–present
- Member of EPA Science Advisory Board Oil Spill Research Strategy Review Panel, 2011

**Recent Honors and Awards:**
- SPE Anthony Lucas Gold Medal, 2010
- National Academy of Engineering, 2003
- SPE Distinguished Lecturer, 1997-98
- Lester C. Uren Award in 1997
Name: Eduardo Gildin, PhD

Academic Rank: Assistant Professor (full time)

Education
Ph.D. (Aerospace Engineering) University of Texas at Austin 2006
M.S. (Mechanical Engineering) University of Sao Paulo, Brazil 1998
B.S. (Mechanical Engineering) Industrial Engineering University, Brazil 1995

Professional Appointment

Assistant Professor Texas A&M University 2010-
Post-Doctoral Fellow University of Texas at Austin 2006-2009
Post-Doctoral Researcher Rice University, Houston 2006-2007
Assistant Instructor University of Texas at Austin 2000-2006

Honors and Awards
Foundation CMG Research Chair 2013-
C.J Craft Faculty Fellowship in Petroleum Engineering 2010-
Post-doctoral Fellowship, ICES-CSM, University of Texas at Austin 2006-2009
College of Engineering's Texas Excellence Teaching Award, UT Austin 2001
Outstanding Achievement in Teaching for the year 2000-01, ASE Dept., UT Austin 2001
Teaching Assistant Fellowship - ASE Department at The University of Texas at Austin 1999-2006
PhD Scholarship - Brazilian Research Council 1999-2003

Relevant Publications
1. G. Fuentes*, E. Gildin, P. Valko, “Analyzing Production Data From Hydraulically Fractured Wells: the Concept of Induced Permeability Field” SPERE-0213-0011. Accepted for Publication.
3. Fuentes*, E. Gildin, P. Valko, “Capturing The Essence Of Flow From Unconventional Reservoirs”, Published Hydraulic Fracture Quarterly
6. Ibrahim, Reza Ghasemi* and E. Gildin, “Reduced Order Modeling In Reservoir Simulation Using the Bilinear Approximation Techniques”. Accepted to SPE LACPEC, to be held in Maracaibo, Venezuela. May 21-23, 2014.
7. S. Afra*, E. Gildin and M. Tarrahi*, “Heterogeneous Reservoir Characterization using Efficient Parameterization through Higher Order SVD (HOSVD)”. Full Paper Accepted to the 2014 IEEE American Control Conference (ACC) to be held in Portland, Oregon. June 4-6, 2014.
8. G. Fuentes*, E. Gildin, P. Valko, SPE-168608-MS, "On the Analysis of Production Data: Practical Approaches for Hydraulically Fractured Wells in Unconventional Reservoirs, accepted to be presented at SPE Hydraulic Fracturing Technology Conference to be held 4 – 6, February, 2014 in The Woodlands, TX, USA.
9. S. Afra* and E. Gildin, “Permeability Parameterization Using Higher Order Singular Value Decomposition (HOSVD)”, Accepted to be presented at the IEEE 12th International Conference on Machine Learning and Applications (ICMLA’13) to be held in Miami, Florida, USA, December 4 – December 7, 2013.
10. X. Wu*, C. Oeth, D. Zhu, A.D. Hill, E. Gildin, “Integrated 3D Acid Fracturing Model for Carbonate Reservoir Stimulation”. In Proceedings of the 2013 Offshore Technology Conference (OTC Brazil), to
be held in Rio de Janeiro, Brazil. October 29-31, 2013.


12. M. Ghommem, V.M. Calo, Y. Efendiev, and E. Gildin, “Complexity Reduction of Multi-Phase Flows in Heterogeneous Porous Media” Accepted to be presented at at the 2013 SPE Kuwait Oil and Gas Show and Conference (KOGS) to be held 07-10 October 2013 at Kuwait International Fair, Mishref, Kuwait.

Undergraduate and Graduate Course Taught:
PETE 301 Petroleum Numerical Methods; PETE 401 Applied Reservoir Simulation; PETE 656 Advanced Numerical Methods for Reservoir Simulation; PETE/CSCE 689 High Performance Computing for Petroleum Engineering

Scientific and Professional Society Membership/Offices:
Member of Society of Petroleum Engineering (SPE); Society of Industrial Applied Mathematics (SIAM); Institute of Electrical and Electronics Engineers (IEEE); International Society for Porous Media (INTERPORE); European Association of Geoscientists and Engineers (EAGE);

Other Recent Professional Activities:
Service:
Associate Editor, SPE Journal, 2011 – Present
PETE Faculty Leader of Study Abroad with Brazil, 2013 and 2014

Industry Short Courses:
Applied Reservoir Simulation
Petroleum Production and Exploration

Expertise/Areas of Interest:
Dr. Gildin expertise is in the area of control of dynamical systems, the mathematics of reservoir simulation, numerical methods for control and model reduction of large-scale systems, finite element modeling, numerical analysis and optimization with an emphasis on petroleum engineering problems.
**Name:** Abu Rashid Hasan  
**Academic Rank:** Professor (full time)

**Degrees:**
- Ph.D. Chemical Engineering, University of Waterloo, Waterloo, Ont., Canada, 1979
- M.S. Chemical Engineering, University of Waterloo, Waterloo, Ont., Canada, 1975
- B.S. Chemical Engineering, University of Engineering and Tech., Dhaka, Bangladesh, 1972

**Professional experience:**
**Texas A&M University, College Station, TX**
Harold Vance Department of Petroleum Engineering  
January, 2012 – present, tenure-track professor of petroleum engineering

**University of Minnesota, Duluth, MN**
College of Science and Engineering  
August, 2002 – May 2007, Department Head and tenured professor of chemical engineering  
June, 2007 – December 2011, tenured professor of chemical engineering

**University of North Dakota, Grand Forks, ND**
School of Engineering and Mines  
August 2000 – May 2002, Chair chemical engineering department  
August 1989 – May 2002, professor of chemical engineering  
August 1979 – July 1989, Assistant/Associate professor of chemical engineering

**University of Waterloo, Waterloo, Ontario, Canada**
Chemical Engineering Department  
1973 – 1979, Graduate teaching/research assistant

**Undergraduate and Graduate Courses Taught:**
- PETE 314 Transport Processes in Petroleum Engineering
- PETE 325 Petroleum Production Systems
- PETE 689 Fluid and Heat Flows in Wellbores
- PETE 618 Modern Production Engineering

**Selected Publications:**

Journal articles: 57  
Books: 1  
Conference Proceedings: 80
Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers SPE

Recent Honors and Awards:
SPE Production & Operations Award, 2011
Endowed Chair, Olson Professor of Engineering, University of North Dakota 1995-2002

Other Recent Professional Activities:
Hess, Houston, TX, 2010 – Present,
Consulted on novel technology for estimating production rate from wellhead pressure/temperature data.

Innergeo, Corpus Christi, TX, 2011-Present,
Consulting, modeled energy extraction in a novel geothermal well.

Chevron, Houston, TX 1992-2010
Modeled transient transport in wellbores, developed more accurate models for flowing fluid temperature, formation temperature, static earth temperature from mud circulation temperature, and multiphase flow.

NASA-Glenn, Cleveland, OH, 1997 – 2001
Contract Researcher, developing thermal/fluids models of propellants for Emerging Launch Capability Development Alternate Access Project.

Service:
Member, SPE Awards Committee 2014-2017
Reviewer, SPE Journals,
Session Chair, ATW Artificial Lift Systems, Phuket, Thailand, Nov. 24-27, 2013

Industry Short Courses:
Fluid- and Heat-Flow Models & Their Practical Applications
Name: Berna Hascakir  
Academic Rank: Assistant Professor (full time)

Degrees:
M.S. Environmental Engineering, Dokuz Eylul University, Izmir, Turkey, 2003
B.S. Environmental Engineering, Dokuz Eylul University, Izmir, Turkey, 2001

Professional experience:

Texas A&M University, College Station, USA
Harold Vance Department of Petroleum Engineering
April 23, 2012-present, assistant professor of petroleum engineering

Schlumberger Oil Service Company
May 2011 - April 2012, senior heavy oil reservoir engineer, Bogota, Colombia
January 2011 – April 2011 reservoir simulation engineer, Abingdon, UK
November 2010 – May 2011, reservoir simulation engineer, Puerto La Cruz, Venezuela.

Pacific Rubiales Energy, Bogota, Colombia
June 2011 – December 2011, consultant on in-situ combustion

Stanford University, Stanford, USA
Energy Resources Engineering Department
October 2008 – June 2010, postdoctoral scholar, In-situ combustion and cyclic steam injection

Inonu University, Malatya, Turkey
Graduate School of Natural and Applied Sciences
September 2008 – December 2008, graduate research assistant

Middle East Technical University, Ankara, Turkey
Petroleum & Natural Gas Engineering Department, Scientific Research Project (BAP), and The Scientific & Technological Research Council of Turkey
January 2004 – September 2008, graduate research and teaching assistant

Harmandali Waste Disposal Site, Izmir, Turkey
February 2003 – August 2003, environmental engineer

Dokuz Eylul University, Izmir, Turkey
Environmental Engineering Department
September 2001 – August 2003, project assistant

Altin Computer Course and Mimar Kemalettin Elementary School, Izmir, Turkey
September 2001 – June 2003, computer instructor

Undergraduate and Graduate Courses Taught:
PETE 310 Reservoir Fluids; PETE 606 EOR Methods Thermal
Selected Publications:

Journal articles: 8
Conference Papers: 23

Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers SPE, Chamber of Turkish Environmental Engineers

Recent Honors and Awards:
SPE Faculty Enhancement Travel Grant for the Gulf Coast North America Region, 2014.
The Scientific and Technological Research Council of Turkey, visiting researcher grant for six months, 2007-2008.
The Scientific and Technological Research Council of Turkey, travel grant, 2006
Clay Mineral Society, travel grant, 2006

Other Recent Professional Activities:
Service:
Mentoring on WITSON to encourage women education in science and engineering, 2012.
Mentoring in SPE, 2013.
Name: Zoya Heidari  
Academic Rank: Assistant Professor (full time)

Degrees:  
Ph.D. in Petroleum Engineering, University of Texas at Austin, 2011  
M.Sc. in Biomechanical Engineering, Sharif University of Technology, 2007  
B.Sc. in Mechanical Engineering, Sharif University of Technology, 2005

Professional Experience:  
Texas A&M University, College Station, USA,  
The Harold Vance Department of Petroleum Engineering  
Fall 2012-present, director of the Joint Industry Research Program on “Multi-Scale Formation Evaluation of Unconventional and Carbonate Reservoirs”  
Fall 2011-present, assistant professor in petroleum engineering

The University of Texas, Austin, USA  
Petroleum Engineering Department  
Fall 2007-2011, graduate research assistant in the Formation Evaluation Research Group  
Fall 2010, teaching assistant in PGE385M, Advanced Well-Logging and Correlation

Marathon Oil Company, Houston, Texas, USA  
Summer 2010, petrophysicist intern

Anadarko Petroleum Corporation, Houston, Texas, USA  
Summer 2008, petrophysicist intern

Sharif University of Technology, Tehran, Iran  
Fall 2005-Summer 2007, graduate assistant  
2003-2004, member of RoboCup Humanoid League Research Team in the Center of Excellence in Design, Automation & Robotics (CEDRA)

Undergraduate and Graduate Courses Taught:  
PETE 321 Formation Evaluation; PETE 311 Reservoir Petrophysics; PETE 608 Well Logging Methods;  
PETE 681 Graduate Seminar Series

Selected Publications:  

Journal Articles: 9  
Patents: 1  
Reports: 2  
Conference Papers: 26  
Invited Lectures: 9

**Scientific and Professional Society Membership/Offices:**
- Member of Society of Petrophysicists and Well Log Analysts SPWLA, Society of Petroleum Engineers SPE,  
- Society of Exploration Geophysicists (SEG), Society of Core Analysts SCA

**Honors, Awards, and Achievements:**
- Recipient of the 2012 SPE Petroleum Engineering Junior Faculty Research Initiation Award, Society of Petroleum Engineers, 2012  
- Recipient of the Chevron Corporation Faculty Fellowship in Petroleum Engineering, 2011-Present  
- 3rd Place of SPWLA Student Poster Competition from Society of Petrophysicists and Well Log Analysts, 2009  
- Fellowship from Petroleum Engineering Department at the University of Texas at Austin, 2009  
- Fellowship from Society of Petrophysicists and Well Log Analysts, Austin Chapter, 2008  
- Fellowship from Petroleum Engineering Department at the University of Texas at Austin, 2007  
- The Best B.Sc. Thesis Award of the Year from Iranian Society of Mechanical Engineers (Aalinasab award), 2006  
- "First Step to Nobel Prize in Physics" Diploma organized under the aegis of the Institute of Physics, Polish Academy of Sciences, 2000

**Other Recent Professional Activities:**
**Services:**
- Member of the Steering Committee for SPWLA Topical Conference on “Educating the Petrophysicist”, 2014.  
- Member of Technology Committee, SPWLA Annual Symposium, July 2013-July 2016.  
- Technical reviewer, SPWLA Petrophysics Journal, January 2013-present  
- Member of Graduate Fellowship Committee of the Petroleum Engineering Department  
- Member of the Faculty Excellence Award Committee of the Petroleum Engineering Department  
- Member of the Graduate Admission Committee of the Petroleum Engineering Department  
- Faculty Advisor for the SPWLA TAMU Student Chapter

**Academic Supervision:**
5 Masters students, 7 Doctorate students, 2 Undergraduate students, 26 Committee member

**Industry Short Courses:**
- Advanced Well Logging Methods and Formation Evaluation
Name: A. Daniel Hill

Faculty Rank: Professor/Department Head (full-time)
Noble Endowed Chair

EDUCATION

- Ph.D., Ch.E., The University of Texas, Austin, Texas 1978
- M.S., Ch.E., The University of Texas, Austin, Texas 1976
- B.S., Ch.E., Texas A&M University, College Station, Texas 1974

PROFESSIONAL EXPERIENCE

Texas A&M University, August, 2004 - present
- Department Head (Jan. 2013-present)
- Professor and Interim Department Head (Jan. 2012-Jan.2013)
- Professor and Associate Department Head (Jan. 2008-Jan. 2012)
- Professor and Assistant Department Head for Graduate Affairs (Jan. 2006-Jan. 2008)

The University of Texas, Sept. 1993 – July, 2004
- Professor

The University of Texas, 1987 - Aug. 1993
- Associate Professor

The University of Texas, 1982 - Aug. 1987
- Assistant Professor

Marathon Oil Denver Research Center, Littleton, Colorado, March 1982 - Aug. 1982
- Advanced Research Engineer

Marathon Oil Denver Research Center, Littleton, Colorado, March 1978 - March 1982
- Research Engineer

RECENT HONORS AND AWARDS:

- SPE Distinguished Member, 1999
- SPE Production and Operations Award, 2008
- R. L. Whiting Endowed Chair, Department of Petroleum Engineering, 2004-present
- Texas Engineering Experiment Station (TEES) 2010-11 Faculty Fellow
- SPE Pipeline Award, 2012
- SPE Gulf Coast Section Regional Distinguished Achievement Award for Petroleum Engineering Faculty, 2013

RECENT PROFESSIONAL ACTIVITIES:

- SPE Production and Operations Advisory Committee, 2009-present
- SPE Production and Operations Award Committee, 2009-2011; Chairman 2010-2011
- SPE Cedric Ferguson Award Committee, 2011-present; Chairman 2012-2013
- SPE Global Training Committee, 2011-present
- SPE Production Monitoring and Control subcommittee 2011-2013
- SPE Well Stimulation subcommittee 2013 - present
- SPE Program Committee, Hydraulic Fracturing Technology Conference, 2013 – present
- Technical Editor, Productions and Operations Journal, 2000 – present
RECENT PUBLICATIONS


Books 4
Book Chapters: 3
Journal Articles: 76
Conference Papers: 168
Patents: 5
Invited Lectures: 84

RECENT SHORT COURSES/WORKSHOPS:

1. Matrix Acidizing
2. Carbonate Stimulation
3. Formation Damage and Acidizing
4. Acid Stimulation Techniques
5. Well Stimulation
6. Production Logging
Name: John E. Jochen, P.E.  Academic Rank: Senior Lecturer (part-time)

Degrees:  M.S. Petroleum Engineering, Texas A&M University, 1993  
          B.S. Petroleum Engineering, Texas A&M University, 1979

Professional experience:

Texas A&M University, College Station, Texas, USA  
Harold Vance Department of Petroleum Engineering  
January 2012 – Present: Senior Lecturer (part-time)

Unconventional Gas Resources, College Station, Texas, USA  
February 2007 – Present: Senior Petroleum Engineer

Schlumberger Data & Consulting Services, College Station, Texas, USA  
November 1997 – January 2007: Principal Production/Reservoir Engineer

S.A. Holditch & Associates, Inc., College Station, Texas, USA  
November 1986 – October 1997: Senior Production Engineer

Tenneco Oil E&P, Houston, Texas, USA  
June 1979 – November 1986: Senior Production Engineer

Undergraduate and Graduate Courses Taught:  
PETE 416: Advanced Production Engineering – spring 2012 to present  
PETE 325: Petroleum Production Systems – fall 2013  
PETE 602: Production Engineering – spring 2003

Publications:

Conference Papers: 12
Invited Lectures: 3

Scientific and Professional Society Membership/Offices:
Member SPE
Registered Professional Engineer, Texas

Other Recent Professional Activities:
Service:
Member of SPE Reprint Series Committee on “Oil & Gas Production Analysis”, 2003
SPE Annual Technical Conference and Exhibition, Session Chairman for Unconventional Gas, 1996
SPE Gas Technology Committee, 1995 - 1996
Name: John E. Killough, P.E.  

Academic Rank: Professor (full time)

Education:
Ph.D. Mathematical Sciences, Rice University, Houston, Texas, 1986.
M.Ch. E. Rice University, Houston, Texas, 1971.
NSF Graduate Fellow in Physical Chemistry, Rice University, 1970-71.
B. A. Chemical Engineering, Rice University, 1970. Graduated Phi Beta Kappa, Magna Cum Laude.

Professional experience:
Texas A&M University, College Station, USA
Harold Vance Department of Petroleum Engineering
January 1, 2012-present, tenure-track professor of petroleum engineering

Halliburton Energy Services
June, 2005-January, 2012, Halliburton Technology Fellow, Reservoir Simulation
June, 2000-June 2005, Landmark Graphics Senior Research Fellow, Reservoir Simulation
September, 1997 – June, 2000, Landmark Graphics Manager of Reservoir Simulation

University of Houston, Houston, Texas, Department of Chemical Engineering
April, 1988 – September, 2007, Associate Professor of Chemical Engineering
April, 1988 – September, 2007, Director of Petroleum Engineering Graduate Program

ARCO Oil and Gas Company, Research and Development, Plano, TX
May 1984 – April, 1988, Senior Research Advisor, Reservoir Simulation
May 1978 – April, 1984, Director of Reservoir Simulation
May 1976 – April, 1978, Senior Research Engineer, Reservoir Simulation

Exxon Production Research Company, Houston, Texas
October 1974-May, 1976, Senior Research Engineer, Reservoir Simulation (on loan to Saudi Aramco)
December, 1970-September, 1974, Research Engineer, Reservoir Simulation

Undergraduate and Graduate Courses Taught:
PETE 322 Geostatistics; PETE 401 Reservoir Simulation (TAMU)
CHEE 401 Senior Ch.E. Laboratory, CHEE 452 Numerical Methods in Ch. E.,
CHEE 634 Reservoir Simulation (University of Houston)

Funding:
2012, Chrisman Institute, Texas A&M, $256,000
2012, Saint Gobain Unconventional Project w/Prof. Heidari, $180,000
2013, Qatar National Research Fund, w/Prof. Fraim, $1,062,000
2013, Skoltech Institute of Technology, Moscow, Russia, $8,775,000

Selected Publications:
BOOKS:
PAPERS:
1. Dobbs, Walt, Browning, Brad, Kumar, Amit, and Killough, John, “Coupled Surface-Subsurface Simulation of the K2 Field, SPE 145070 to be presented at the SPE ATCE, Denver, CO, October 30-November 1, 2011.
12. (Submitted to the Journal of Scientific Computing, publication pending.)

Book: 1
Journal articles: 16
Patents: 4
Conference Proceedings: 53

Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers SPE, European Association of Geophysics and Engineers

Honors and Awards:
SPE Reservoir Characterization and Dynamics Award, 2013.
University of Houston, Professor of the Year in Chemical Engineering, 1994.
AIME (SPE) Rossiter W. Raymond Award, 1977.

Other Recent Professional Activities:
Service:
SPE Education and Accreditation Committee, Vice Chairman, 2013-2016.

Industry Short Course: Advanced Surface/Subsurface Reservoir Simulation
Name: Michael J. King            Academic Rank: Professor (full-time)

Degrees: Ph.D., Physics, Syracuse University, Syracuse, NY, 1980
         M.S., Physics, Syracuse University, Syracuse, NY, 1977
         B.S., Summa Cum Laude, Physics & Mathematics, Cooper Union, New York, NY, 1976

Professional experience:
Texas A&M University, College Station, USA, Harold Vance Department of Petroleum Engineering
July 2009-present, tenured professor of Petroleum Engineering and Assistant Department Head for Administration and holder of the LeSuer Chair in Reservoir Management

BP America / BP Amoco E&P Upstream Technology Group:
1999 – June 2009, Houston, TX and Aberdeen, Scotland, UK
   • 2005-2009 Senior Advisor, Reservoir Modeling & Simulation
   • 2002-2009 Project Manager, Reservoir Performance Prediction R&D
   • 2007-2008 Discipline Technical Authority, Reservoir Performance Prediction
   • 2007-2008 Global Deployment Manager, Reservoir Performance Prediction
   • 2002-2007 Technology Network Leader, Reservoir Performance Prediction
   • 2002-2005 Advisor, Reservoir Modeling & Simulation
   • 1999-2001 Technology Network Leader, Reservoir Modeling & Characterization

Asset-Based Consultant & Senior Reservoir Engineer: BP Exploration
1997-1999 Magnus Field, Aberdeen, Scotland, UK
1996 Prudhoe Bay Equity (Alignment Team), Houston, TX
1995 Foinaven Field, Aberdeen, Scotland, UK

Research Positions: BP Research & Exploration, Sunbury-on-Thames, UK
1994-1995 Technology Leader, Subsurface MTL
1992-1994 Team Leader, Integrated Reservoir Description
1991-1992 Team Leader, Fluid Flow

Research Positions: Sohio / Standard Oil / BP Research, Warrensville, OH
1988-1990 Senior Project Leader / Research Scientist
1985-1987 Project Leader, Theory Group (Fluid Flow)
1982-1984 Senior R&D Physicist, Reservoir Simulation

Research Associate, Nuclear Physics, Argonne National Laboratory, Chicago, IL
Summer 1982, Research Associate, relativistic meson spectroscopy and quantum field theories

Department of Physics, Michigan State University, E. Lansing, MI
1980-1982 Research Associate, relativistic meson spectroscopy and perturbative quantum chromodynamics

Undergraduate and Graduate Courses Taught:
PETE 645 Geologic Models for Flow Simulation; PETE 665 Reservoir Engineering
PETE 324 Well Performance; PETE 401 Applied Reservoir Simulation

Selected Publications:


Journal articles: 36
Patents: 1 (in process)
Reports, Books and Book Chapters: 4
Presentations-Invited: 103

Scientific and Professional Society Membership/Offices:
- Member, Society of Petroleum Engineers (SPE)
- Member, Society for Industrial and Applied Mathematics (SIAM)
- Member, American Geophysical Union (AGU)
- Member, Sigma Xi Scientific Research Society
- Member, Energistics RESQML Special Interest Group

Recent Honors and Awards:
2013 SPE Distinguished Member
2013 Foundation CMG Chair
2013 Energistics Volunteer Recognition Program Award for 2012 and 2013
2012 Petroleum Engineering Department Award for Excellence in Teaching
2011 SPE Reservoir Description and Dynamics Award
2006-2007 SPE Distinguished Lecturer
1982 American Physical Society Industrial Post-Doctoral Fellowship
1976-1980 Graduate Fellowship, Syracuse University
1976 Honorable Mention, National Science Foundation Fellowship
1976 The Henry D. Dickinson fund prize
1976 The Harry W. Reddick fund prize
1973 The Day Class of 1907 Award

Other Recent Professional Activities:
- Foundation CMG Chair
- Chair / Co-Chair, RESQML Executive Committee, 2011 to present
- Steering Committee, Crisman Institute, Texas A&M, 2010 to present
- Technical Reviewer, Society of Petroleum Engineering, 2010 to present

Industry Short Courses:
“Upgridding and Upscaling: Current Trends and Future Directions”
SPE Distinguished Lecture Series
Name: Robert H. Lane  

Academic Rank: Professor (tenure track, full time)

Degrees:  
Ph.D. Chemistry, University of Florida, Gainesville, 1971  
B.S. Chemistry University of North Carolina, Chapel Hill, 196

Professional experience:
Texas A&M University, College Station, TX  
Harold Vance Department of Petroleum Engineering  
August 1, 2007- present, tenure-track professor of petroleum engineering

Petroleum Institute, Abu Dhabi, UAE  
Petroleum Engineering Program  
August 1, 2003-October 2004, professor of petroleum engineering  
October 2004 – January 2005, professor and acting program director of petroleum engineering  
February 2005 – July, 2007, professor and program director of petroleum engineering

Northstar Technologies International, Anchorage, AK; Houston, TX  
Independent Petroleum Consultancy  
August 1995 – February 1997, founder/full time consultant, Anchorage, AK  
February 1997 – August 2003, founder/full time consultant, Houston, TX

ARCO Alaska, Inc., Anchorage, AK  
Prudhoe Bay Operations Engineering  
June 1990 – July 1995 principal staff engineer, Well Operations Engineering Anchorage/Prudhoe Bay

ARCO Research and Technical Services, Plano, TX  
West Sak Research Group  
March 1986 – May 1990, research director, West Sak Wells Group  
August 1985 – March 1986, research director, Long Range Research

Atlantic Richfield Company, Los Angeles, CA  
ARCO Corporate Technology  
July 1983 – July 1985 project leader

Occidental Petroleum Corporation, Irvine CA  
Occidental Research Corporation  
July 1980 – July 1983, senior research scientist

University of Georgia, Athens, GA  
Department of Chemistry  
August 1973 – June 1980, instructor, assistant professor of chemistry

Oregon Graduate Institute, Beaverton, OR  
Department of Chemistry  

Undergraduate and Graduate Courses Taught:

Selected Publications:

Book Chapters: 1
Journal articles: 18
Conference Papers: 30
Invited Lectures: 50+
Patents: 5

Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers SPE

Recent Honors and Awards:
Aghorn Energy Development Professorship, 2008 – 2014
SPE Distinguished Member, 2011
William Keeler Faculty Fellow, 2012

Other Recent Professional Activities:
Service:
Program Chair, SPE International Symposium on Oilfield Chemistry, 2013

Industry Short Courses:
Subsurface Water Management
Conformance Improvement for Enhanced Oil Recovery

Industry Consulting
Ram Energy
Petroleos de Mexicano (PEMEX)
Baker Hughes, Inc
Maersk Oil Qatar
Name: Jiajing Lin

Academic Rank: Assistant Lecture (full-time)

Degrees: Ph.D. Petroleum Engineering, Texas A&M University, 2011
M.S. Petroleum Engineering, University of Louisiana at Lafayette, 2006
B.S. Electronic Engineering, Beijing Institute of Technology, China, 2004

Professional experience:

Texas A&M University, College Station, USA
Harold Vance Department of Petroleum Engineering
January 1, 2012-present, full time assistant lecture of petroleum engineering

Texas A&M University, College Station, USA
Harold Vance Department of Petroleum Engineering
2007 – 2011, Graduate research assistant

Precision Reservoir Modeling, Houston
2006 – 2007, Reservoir Engineer

University of Louisiana at Lafayette, USA
Department of Petroleum Engineering
2004 – 2006, Graduate research assistant

Undergraduate Courses Taught:
PETE 401 Production Systems; ENGR 111, 112 Foundations of Engineering

Selected Publications:

Conference Proceedings: 6

Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers SPE
Name: J. Bryan Maggard  Academic Rank: Senior Lecturer (full time)

Degrees:  
Ph.D. Petroleum Engineering, Texas A&M University, 2000  
M.S. Petroleum Engineering, Texas A&M University, 1990  
B.S. Petroleum Engineering, Texas A&M University, 1987

Professional Experience:  
Texas A&M University, College Station, USA  
Harold Vance Department of Petroleum Engineering  
- Senior Lecturer and Assistant Department Head, Undergraduate Programs, 2006-present  
- Lecturer, 2000-2006, Assistant Lecturer, 1998-2000  
Recent Undergraduate and Graduate Courses:  
  PETE 301 Petroleum Engineering Numerical Methods, 2014  
  PETE 400 Reservoir Description (Capstone Design, Integrated Reservoir Study) 2014  
  PETE 603 Advanced Reservoir Engineering I, 2012  
  PETE 611 Application of Petroleum Reservoir Simulation, 2013  
  ENGR 111/112 Foundations of Engineering I/II, 2014

Chevron Exploration and Production Services Company, Houston, USA  
Reservoir Engineer, 1991

Pierce Oil & Gas Corporation, Ft. Worth, USA  
Drilling and Production Engineer, 1987-1988

Selected Publications:  


Book Chapters: 2
Conference Papers: 6

Honor and Professional Society Membership:
- Society of Petroleum Engineers, SPE, 1983
- Pi Epsilon Tau - Petroleum Engineering Honor Society, 1986
- Tau Beta Pi - Engineering Honor Society, 1985

Professional Activities:
Service:
- Society of Petroleum Engineers, North America Gulf Coast Region, STAR Scholarship Selection Committee, 2008-present
- Texas Board of Professional Engineers, Administration of Fundamentals of Engineering Examination, College Station, Texas, 2001
- Dwight Look College of Engineering, Coordinator, Conservation Principles in Engineering Mechanics, ENGR 211, 2002-2005
- Harold Vance Department of Petroleum Engineering, Scholarship Committee, Chair, 2006-present
- Harold Vance Department of Petroleum Engineering, Undergraduate Curriculum Committee, 2006-present

Recent Industry Short Courses:
- SPE, Denver Section, Production Decline Analysis, Vertical and Horizontal Wells, 2013
- NExT, Reservoir Engineering Aspects of Shale Plays, 2013
- NExT, Applied Reservoir Simulation, 2008-present
- NExT, Analysis and Development of Tight Gas Reservoirs, 2007-present
- NExT, Conducting an Integrated Reservoir Study, 2006-present
- NExT, Reservoir Engineering (various courses), 2002-present
- Southwestern Petroleum Short Course, Reservoir Engineering Aspects of Gas Well Deliquification, 2008
Name: William D. McCain, Jr., P.E.  Academic Rank: Visiting Professor (part-time)

Degrees:  Ph.D. Chemical Engineering, Georgia Institute of Technology, 1964
          M.S. Chemical Engineering, Georgia Institute of Technology, 1961
          B.S. Chemical Engineering, Mississippi State University, 1956

Professional experience:

Texas A&M University, College Station, USA
Harold Vance Department of Petroleum Engineering
January 1, 1991 - present, visiting professor of petroleum engineering

Schlumberger, Holditch-Reservoir Technologies
August, 1999 - November 2000, reservoir engineering advisor

S. A. Holditch & Associates, Inc.
January, 1991 – August, 1999, executive vice president & chief engineer

Cawley, Gillespie & Associates, Inc.

United States Army
August, 1976 – March, 1984, colonel, general staff, placed on retired list as brigadier general

Mississippi State University
1965 – 1976, professor and head of department of petroleum engineering
1963 – 1965, associate professor of petroleum engineering

Esso Research Laboratories, Baton Rouge, LA
1956 – 1959, engineer and project leader

United States Army
1951 – 1953, sergeant first class, artillery

Undergraduate and Graduate Courses Taught:
PETE 310 Properties of Petroleum Fluids; PETE 605 Phase Behavior Petroleum Reservoir Fluids; PETE 665 Reservoir Engineering

Selected Publications:


- Books: 4
- Journal articles: 33
- Patents: 3
- Conference Papers: 21
- Invited Lectures: 61

**Scientific and Professional Society Membership/Offices:**
Member of the Society of Petroleum Engineers SPE

**Recent Honors and Awards:**
SPE Distinguished Member, 2005
SPE Legion of Honor, 2012

**Industry Short Courses:**
Review for the Principles and Practice Examination
Reservoir Engineering, Reservoir Simulation
Reservoir Fluid Properties
Gas Condensate Reservoir Engineering
Equations of State for Compositional Simulation
Waterflooding
Name: Priscilla G. McLeroy, P.E.  
Academic Rank: Professor of Practice (full time)

Degrees:  
M.S. Petroleum Engineering, Stanford University, 1986  
B.S. Biophysics, University of Houston, 1979

Professional experience:

Texas A&M University, College Station, USA  
Harold Vance Department of Petroleum Engineering  
January 1, 2012-present, non-tenured professor of practice of petroleum engineering

Oliver Wyman, Inc., Houston, TX USA  
Partner & Global Upstream Leader  
March 2010 – December 2011

Arthur D. Little, Inc., Houston, TX USA  
Managing Director, Americas  
March 2007 – February 2010

Jefferies & Co., Houston, TX USA  
Managing Director  
January 2005 – March 2007

Avatar Associates, LLC, Houston, TX USA  
Principal  
November 2000 – December 2004

SRI Consulting, Houston, TX USA  
Vice President  
November 1998 - November 2000

Chevron Corporation, California and Texas  
Engineer and Manager  
March 1986 – March 1996

British Petroleum, San Francisco, CA  
Reservoir Modeler  
1983 – August 1984

Undergraduate and Graduate Courses Taught:  
PETE 400 Reservoir Description, PETE 324 Well Performance, PETE 335 Technical Presentations, PETE 617 Petroleum Reservoir Management, PETE 621 Petroleum Development Strategy, PETE 685 Directed Study, PETE 692 Professional Study

Selected Publications:  
   Hydrocarbon World, Vol.7 Issue 1, June 2012.

Scientific and Professional Society Membership/Offices:
Member & Past Chapter President of the Society of Petroleum Engineers SPE, Licensing Executive Society

Recent Professional Activities:
Service:
Oil & Gas Awards, Judge
SPE Economics & Management Journal, SPE Technical Editor

Industry Short Courses:
Mergers and Acquisitions for O&G Executives
Strategic Management in the Petroleum Industry
Petroleum Economics
Intellectual Asset Management
Energy Project Management
Name: Duane A. McVay, P.E.  
Academic Rank: Professor (full time)

Degrees:  
Ph.D. Petroleum Engineering, Texas A&M University, 1994  
M.S. Petroleum Engineering, Texas A&M University, 1982  
B.S. Petroleum Engineering, Texas A&M University, 1980

Professional experience:  

Texas A&M University  
Professor, Department of Petroleum Engineering (2011-present); Associate Professor,  
Department of Petroleum Engineering (1999-2011, granted tenure 2005); Visiting  
Assistant Professor, Department of Petroleum Engineering (1998-1999).

Schlumberger Holditch-Reservoir Technologies  
Principal Consultant (1999).

S. A. Holditch & Associates, Inc.  
Senior Vice-President and Technology Specialist (1998-1999); Vice-President and  
Technology Specialist (1997-1998); Vice-President and Manager of Reservoir Studies  
Group (1992-1997); Senior Petroleum Engineer (1986-1992); Petroleum Engineer (1982-  
1986).

Texas A&M University  
Graduate Teaching Assistant (1981-1983).

Getty Oil Research Company  
Petroleum Engineer (summer 1982).

Reservoir Simulation Technology  

Undergraduate and Graduate Courses Taught:  
PETE 400 Integrated Reservoir Studies; PETE 401 Applied Reservoir Simulation; PETE 403  
Petroleum Project Evaluation; PETE 322 Geostatistics; PETE 335 Technical Presentations I;  
PETE 435 Technical Presentations II; ENGR 112 Fundamentals of Engineering II; PETE 611  
Application of Petroleum Reservoir Simulation; PETE 603 Advanced Reservoir Engineering I;  
PETE 685/689 Integrated Reservoir Studies

Selected Publications:  
Unconventional Gas Resource Assessment. SPE \Economics \& \Management, Vol. 4, No. 4, pp. 222-234, October.
Ultimately Recoverable World Conventional Oil Resources. SPE \Economics \& \Management, Vol. 3, No. 2, pp. 79-92, April.
4. Liu, C. and McVay, D.A. 2010. Continuous Reservoir Simulation Model Updating and  
Forecasting Improves Uncertainty Quantification. SPE \Reservoir Evaluation \& \Engineering, Vol. 13, No. 4, pp. 626-637, August.

Journal articles: 36  
Book Chapters: 2  
Conference Proceedings: 74

**Scientific and Professional Society Membership/Offices:**
Member of the Society of Petroleum Engineers SPE

**Recent Honors and Awards:**
Rob L. Adams ’40 Professorship, 2012-present.
Outstanding Technical Editor Award, SPE Journal of Canadian Petroleum Technology, 2012
Charles W. Crawford Service Award, Dwight Look College of Engineering, Texas A&M University, 2011-2012
ConocoPhillips Faculty Sponsorship Award, 2010.
Michael & Heidi Gatens Development Professor in Unconventional Resources, 2008-2012.
Distinguished Member, Society of Petroleum Engineers, 2007.
ConocoPhillips Faculty Fellow, 2007.

**Other Recent Professional Activities:**
**Service:**
Society of Petroleum Engineers, Member of Reservoir Description & Dynamics Award Committee, Appointed, 2009-2012.
Technical Editor, SPE Reservoir Evaluation & Engineering Editorial Review Committee, Appointed, Member 2007-present.
Unconventional Gas Subgroup, Technology Task Group, Committee on Global Oil and Gas, Appointed, Member, 2006-2007. This committee produced the July 2007 report of the National Petroleum Council “Facing the Hard Truths about Energy.”

**Industry Short Courses:**
Applied Reservoir Engineering  
Reservoir Simulation Strategies
Name: George J. Moridis  
Academic Rank: Visiting Professor (part-time)

Education
1987  Ph.D. (Reservoir Engineering), Texas A&M University, Texas
1982  M.Sc. (Agricultural and Civil Engineering), Texas A&M University, Texas
1980  M.E. (Chemical Engineering), National Metsovion Technical University, Greece
1979  B.Sc. with Honors, (Chemical Engineering), National Metsovion Technical University, Greece

CURRENT POSITION AND EXPERIENCE (1991 – Present)
Lawrence Berkeley National Laboratory (LBNL), University of California
   Head, Hydrocarbon Resources Program (5/2013 to present)
   Deputy Program Lead for Energy Resources (9/2009 to 5/2013)
   Research Area Leader and Principal Investigator, Transport and Thermodynamics (2003 to 9/2009)
   Group Leader and Principal Investigator, Tight Gas Studies (2007 to present)
   Group Leader and Principal Investigator, Gas Hydrate Studies (1998 to present)
   Group Leader and Principal Investigator, Contaminant Hydrology (2000 to 2003)
   Group Leader and Principal Investigator, Subsurface Containment Technologies (1991 to 2001)

Visiting Professor, Petroleum Eng. Dept., Texas A&M University, College Station, Texas (2006 to present)
Adjunct Professor, Chemical Eng. Dept., Colorado School of Mines, Golden, Colorado, USA (2003 to present)
Visiting Professor, Guangzhou Center for Gas Hydrate Research, Guangzhou Institute for Energy
   Conversion, Chinese Academy of Sciences, China (2009 to present)
Adjunct Professor, Petroleum and Natural Gas Engineering Dept., Middle East Technical University,
   Ankara, Turkey (2005 to present)

COURSES TAUGHT (2006 – Present)
PETE640 – Models for Simulation of Flow and Transport of Fluids and Heat in Porous Media, PETE41
   – Models for Simulation of Advanced Coupled Processes in Geologic Media, PETE689 – High-
   Performance Computing Applications in Petroleum Engineering and Geosciences (regular course
   beginning in Fall of 2014)

SELECT PUBLICATIONS (72 peer-reviewed papers, 200+ reports and conference papers, 3 book
   chapters, 3 patents)
Olorode, O.M., Freeman, C.M., G.J. Moridis, and T.A. Blasingame, High-Resolution Numerical Modeling
   of Complex and Irregular Fracture Patterns in Shale Gas and Tight Gas Reservoirs, SPE Reservoir
   Evaluation & Engineering, 16(4), 443-455.
Freeman, C.M., G.J. Moridis, D. Ilk, and T.A. Blasingame, A Numerical Study of Performance for Tight
   2013.
Kim, J., and G.J. Moridis, Development of the T+M coupled flow-geomechanical simulator to describe
   fracture propagation and coupled flow-thermal-geomechanical processes in tight/shale gas systems,
   Computers & Geosciences, 60, 184-198.
Rutqvist, J., A. Rinaldi, F. Cappa and G.J. Moridis, Modeling of fault reactivation and induced seismicity
   during hydraulic fracturing of shale-gas reservoirs, Journal of Petroleum Science and Engineering,
   107, 31-44.
Moridis, G.J., M.T. Reagan, H. Anderson-Kuzma, T.A. Blasingame, Y.W. Huang, R. Santos, K. Boyle,
   C.M. Freeman, D. Ilk, M. Cossio, S. Bhattacharya, and M. Nikolaou, SeTES: A Self-Teaching Expert
   System for the Analysis, Design, and Prediction of Gas Production From Unconventional Gas Resources,
   Computers & Geosciences, 58, 100-115.


PROFESSIONAL AFFILIATIONS
American Geophysical Union, American Society of Agricultural Engineers, American Institute of Chemical Engineers, American Society of Civil Engineers, Society of Petroleum Engineers, Association of Ground Water Scientists and Engineers, NWWA, Society for Industrial and Applied Mathematics, Society for Mining, Metallurgy and Exploration (OTC Board Member, ATC Board Member)

SELECT HONORS, RECOGNITIONS & AWARDS
2013: *Appointment to the U.S. Secretary of Energy’s Methane Hydrate Advisory Committee*

2011: *Institute for Advanced Sustainability, Potzdam, Germany, November 2011: Invited Speaker, conference on “Energy from clathrate hydrates”*


2010: *Society of Petroleum Engineers: Distinguished Member (Fellow Grade)*

2009-2010: *Society of Petroleum Engineers: Distinguished Lecturer*

2007: Editorial Board of Water Resources Research: Outstanding Reviewer Award

2005: Editorial Board of Water Resources Research: Outstanding Reviewer Award

OTHER PROFESSIONAL ACTIVITIES
Editorships: Transport in Porous Media (Member of the Editorial Board; Associate Editor; Guest Editor of the 2009 and 2012 TOUGH Symposium Special Issues); Journal of Natural Gas Science and Engineering (Member of the Editorial Board; Associate Editor); SPE Journal (Associate Editor); Computers & Geosciences (Member of the Editorial Board; Guest Editor of the 2012 TOUGH Symposium Special Issue); Nuclear Technology (Guest Editor of the 2009 and 2012 TOUGH Symposium Special Issues)

Reviewing: 26 scientific journals
Name: Hadi Nasrabadi  

Academic Rank: Assistant Professor (full time)

Degrees:  
Ph.D. Petroleum Engineering, Imperial College, London, UK 2006  
B.S. Civil Engineering, Sharif University of Technology, Tehran, Iran 2002

Professional Experience:  
Texas A&M University, College Station, USA  
Harold Vance Department of Petroleum Engineering  
January 1, 2013-present, assistant professor of petroleum engineering  
January 1, 2012- December 31, 2012, visiting assistant professor of petroleum engineering

Texas A&M University at Qatar, Doha, Qatar  
Petroleum Engineering Program  
January 1, 2010- December 31, 2011, assistant professor of petroleum engineering  
January 1, 2007- December 31, 2011, visiting assistant professor of petroleum engineering

Undergraduate and Graduate Courses Taught:  
PETE 323 Reservoir Models; PETE 401 Reservoir Simulation

Selected Publications:  

Journal articles: 8  
Conference Papers: 14

Scientific and Professional Society Membership/Offices:  
Member of the Society of Petroleum Engineers SPE, Sigma Xi Scientific Research Society

Other Recent Professional Activities:  
Service:  
Name: Hisham A. Nasr-El-Din  

Academic Rank: Professor (full time)

Degrees:  
- Ph.D. Chemical Engineering, University of Saskatchewan, Canada, 1984  
- M.S. Chemical Engineering, University of Cairo, Egypt, 1977  
- B.S. Chemical Engineering, University at Cairo, Egypt, 1973

Professional experience:  

Texas A&M University, College Station, Texas  
Harold Vance Department of Petroleum Engineering  
December 5, 2007 - present, tenured professor of petroleum engineering

Saudi Aramco Oil Company, Saudi Arabia  

University of Alberta, Edmonton, Canada  
Chemical Engineering Department  
May 1, 1990 – present, Adjunct Professor of chemical petroleum engineering

Petroleum Recovery Institute, Calgary, Alberta, Canada  

University of Alberta, Edmonton, Canada  
Chemical Engineering Department  
February 1, 1987 – August 1988, Research Associate

University of Ottawa, Canada  
Chemical Engineering Department  
November 1985 – January 1987, Post-Doctoral Fellow

University of Saskatchewan, Canada  
Chemical Engineering Department  
May 1984 – October 1985, Post-Doctoral Fellow

University of Cairo, Egypt  
Chemical Engineering Department  
October 1973 – August 1980, Instructor

Undergraduate and Graduate Courses Taught:  
PETE 311 Reservoir Petrophysics; PETE 602 Well Stimulation, PETE 643 Oil Field Chemistry

Selected Publications:  

Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers (SPE) and the Canadian Society for Chemical Engineering (CSChE).

Recent Honors and Awards:
- SPE Distinguished Achievement Award for Petroleum Engineering Faculty, 2013
- SPE Outstanding Associate Editor (SPEJ) Award, 2009
- SPE Production and Operations Award, 2009
- SPE Outstanding Associate Editor (SPEJ) Award, 2008
- SPE Outstanding Technical Editor (SPEPO) Award, 2008
- SPE Distinguished Member Award, 2007
- SPE Production and Operations Regional Award, 2006

Other Recent Professional Activities:
Service:
Chaired several sessions in SPE, CSChE, and AOCS conferences.
Invited to give presentations at various universities, services companies, and research organizations all over the globe.
Acting as a member for the SPE selection committees for Oilfield Chemistry, Oilfield Corrosion, and Well Stimulation.
Selected as a Committee Member for SPE ATW on “Well Acidizing,” Malaysia, Nov. 2004.
Selected to chair SPE ATW on “Oilfield Chemistry,” held in Bahrain, December 2004.
Selected as a Committee Member for SPE ATW on “Produced Water Re-injection,” Biarritz, France, June 20-24, 2005.
Selected as a Discussion Leader for SPE ATW on “Matrix Acidizing,” Moscow, Russia, 31st October - 3rd November 2005.
Selected as a Committee Member for SPE ATW on "Chemical Methods of Reducing Water Production," San Antonio, Texas, 4 - 6 March 2007.
Consulted for major oil and gas companies all over the world.
Gave short courses in Egypt, Malaysia, The Netherlands, Norway, Saudi Arabia, Mexico, United States of America, and other places.
Name: Sam Noynaert

Academic Rank: Assistant Professor (full time)

Degrees:
- Ph.D., Petroleum Engineering, Texas A&M University, 2013
- M.S., Petroleum Engineering, Texas A&M University, 2004
- B.S., Agricultural Engineering, Texas A&M University, 2002

Professional Experience:
Texas A&M University, College Station, USA
Harold Vance Department of Petroleum Engineering
September 1, 2013-present, assistant professor of petroleum engineering
August 2009-August 2013, lecturer of petroleum engineering

EOG Resources
January 2008-August 2009, drilling engineer

BP America and BP Alaska
September 2004-January 2008, rig supervisor – drilling/completions

Courses Taught:
PETE 225 – Introduction to Drilling Systems (Fall 2009 – Spring 2014)
PETE 405 – Drilling Engineer (Spring 2014)

Publications

Research/Funding
January 2014 – International Ocean Drilling Program
- Feasibility study focused on drilling fluids and hydraulics for 3000 meter core
February 2011 - Halliburton Directional Drilling Training
- Halliburton uses Drilling Simulator 9 - 12 weeks/year to train directional drillers
Other Academic activities:

2010 – Present
Stripper Well Consortium – TAMU Representative
• DOE funded organization to promote stripper well technology application
• Served on 2010 & 2012 executive committee making funding allocation decisions
• $500,000 - $1,000,000 given annually in $50,000 - $250,000 increments

2011 – Present
ASME Journal Reviewer

2013 – Present
SPE Technical Editor for Editorial Review Committee – Drilling and Completions

Certifications
Engineer-in-Training - Certified E.I.T. by Texas Board of Professional Engineers (2003).
Name: Teri Reed

Academic Rank: Associate Professor (full time)

Degrees: Ph.D. Industrial Engineering, Arizona State University, 1999
         M.B.A. Management, University of Texas of the Permian Basin, 1992
         B.S. Petroleum Engineering, University of Oklahoma, 1985

Professional experience:
Texas A&M University, College Station, TX, USA, Harold Vance Department of Petroleum Engineering
   April 1, 2013 – present, Assistant Agency Director for Workforce Development of the Texas Engineering
   Experiment Station
   January 1, 2013-present, tenured Associate Professor of Petroleum Engineering, Assistant Vice Chancellor
   for Student Affairs, and Assistant Dean for Student Affairs

Purdue University, West Lafayette, IN, USA
   School of Engineering Education
   June 2006 – December 2012, tenured Associate Professor of Engineering Education, Assistant Dean of
   Engineering for Undergraduate Education
   July 2008 – December 2012, Director First-Year Engineering program
   June 2006 – November 2008, Founding Executive Director of the Institute for P-12 Engineering Research
   and Learning (INSPIRE)

University of Oklahoma, Norman, OK, USA
   School of Industrial Engineering
   June 2006, tenured Associate Professor of Industrial Engineering
   January 2005 – June 2006, Associate Dean for Engineering Education
   August 2003 – December 2004, Director of Engineering Education
   January 2000 – May 2006, Assistant Professor of Industrial Engineering

Arizona State University, Tempe, AZ, USA
   College of Engineering and School of Industrial Engineering
   October 1998 – October 1999, Strategy Director of Assessment and Evaluation, NSF funded Foundation
   Coalition
   August 1997 – October 1998, ASU Assessment Coordinator, NSF funded Foundation Coalition
   1994 – 1996, Graduate Research Assistant and Teaching Assistant

Enserch Exploration, Inc.
   1989 – 1992, Petroleum Engineer II – Midland, Texas
   1987 – 1992, Petroleum Engineer I – Dallas, Texas
   1985 – 1987, Associate Petroleum Engineer – Dallas, Texas

Sun Exploration & Production Company (Oryx)
   1982 and 1983, Summer Engineer, Breckenridge, Texas and Chickasaw, Oklahoma

Halliburton Services
   1981, Summer Clerk in Surface Engineering, Duncan, Oklahoma

Undergraduate and Graduate Courses Taught:
   PETE 322 Geostatistics; ENGR 111 Foundations of Engineering I

Selected Publications:
1. Duval-Couetil, Nathalie, Angela Shartrand, and Teri Reed-Rhoads. (2014). "The Role of
   Entrepreneurship Program Models and Experiential Activities on Engineering Student Outcomes,"


Journal articles: 23
Reports, Books and Book Chapters: 1
Refereed Conference Proceedings: 62
Funded Research Grants as Principal Investigator: 13
Funded Research Grants as Co-Principal Investigator (external only): 24

Scientific and Professional Society Membership/Selected Offices:
Fellow of the American Society for Engineering Education (ASEE)/Diversity Committee Chair,
Undergraduate Experience Council Co-Chair, K-12 Division President, ERM Division Secretary/Treasurer, ASEE Program and FIE Program Chair
American Society for Quality (ASQ), Education Division Secretary
Society of Petroleum Engineers (SPE)/U.S. Council Member Benefits Committee, various offices in Permian Basin Section and Dallas Section including Program Chair Hydrocarbon and Economic Evaluation Symposium
Member of Institute of Electronics and Electrical Engineers (IEEE), Alpha Pi Mu, Pi Epsilon Tau, and Tau Beta Pi

Recent Honors and Awards:
Sharon Keillor Award, awarded by the American Society for Engineering Education, 2013
2013 ASEE Environmental Engineering Division Best Paper Award
One Brick Higher Award, Recipient, awarded by the Purdue University President, 2012
ASEE Fellow, 2010
Purdue University Mortar Board Honorary Faculty, Class of 2011
ASEE Outstanding Service Award, ERM Division, 2008
Committee on Institutional Cooperation Academic Leadership Program, 2007-2008 Faculty Fellow
Frontiers in Education, New Faculty Fellow, 2001
Educators’ Leadership Academy 2001-2002, Outstanding Professors Participant
Regional Service Award, Society of Petroleum Engineers, 1992
Young Member Outstanding Service Award, Society of Petroleum Engineers, 1987
Inaugural recipient of the Regents’ Alumni Award, University of Oklahoma, 1987

Other Recent Professional Activities:
Quality Engineering, Editorial Board Member, 2006 to 2008.
Name: David S. Schechter, P.E.  

Academic Rank: Associate Professor (full time)

Degrees:
- Ph.D. Physical Chemistry, Bristol University, 1988
- B.S. Chemical Engineering, University of Texas at Austin, 1984

Professional Experience

2000 – present Associate Professor of Petroleum Engineering, Harold Vance Department of Petroleum Engineering, Texas A&M University, Tenured 2005. Currently Dr. Schechter supervises 12 graduate students.

April 2010 – Current, Consultant Chaparral Energy, Oklahoma City, OK – Consulting reservoir engineer on development of large $125 MM (USD) WAG project in the North Burbank Unit in Oklahoma. Present work involves reservoir simulation of WAG process using CO2, laboratory work determining fluid and rock properties for WAG and consultant on implementation of project.

May 2012 – Current, Consultant, Pioneer Natural Resources, Las Colinas, TX – Consulting reservoir engineer on develop of Wolfcamp oil shale in west Texas. Involved in all aspects of reservoir engineering in the Wolfcamp from formation evaluation to well construction. Also consulting on large scale development of water injection in the Spraberry Trend Area. Worked with Parker and Parsley (now Pioneer Natural resources) for 19 years as researcher, intern, technical specialist and consultant.

May 2011 – August, 2011 Technical Specialist, Pioneer Natural Resources, Las Colinas, TX – Worked as a summer intern to interpret large scale tracer testing in 200 acre waterflood. Consulted on coring horizontal wells in Wolfcamp shale.

May 2006 – August, 2006 Technical Specialist, Pioneer Natural Resources, Las Colinas, TX – Worked as a summer intern to perform reservoir characterization, EOR in the Spraberry Trend Area, west Texas and also to come up with development opportunities in the Spraberry Trend Area.

May 2005 – August, 2005 Technical Specialist, Pioneer Natural Resources, Las Colinas, TX - Worked as a summer intern to perform reservoir characterization, EOR in the Spraberry Trend Area, west Texas and also to come up with development opportunities in the Spraberry Trend Area.


1996-2000 – Associate Professor of Chemical Engineering, Petroleum and Chemical Engineering Department, New Mexico Institute of Mining and Technology

1996 – 1997 – Interim Director, Petroleum Recovery Research Center, New Mexico Institute of Mining and Technology

1990–1993 – Acting Assistant Professor, Department of Petroleum Engineering, Stanford University

1989–1990 – Post-Doctoral Research Associate, Department of Petroleum Engineering, Stanford University

1984–1988 – Chemistry Department Teaching/Research Assistant, Bristol University, England

1980–1984 – Chemistry Department Research Assistant, The University of Texas at Austin

Undergraduate and Graduate Courses Taught:
- Chemical Reaction Kinetics
- Thermodynamics of Phase Equilibria
- Interfacial and Capillary Phenomena
- Formation Evaluation – Open Hole Logging
- Reservoir Fluids Lab
- Core Analysis Lab
- Integrated Reservoir Studies
- Applied Reservoir Simulation
- Naturally Fractured Reservoir Engineering and EOR

Selected Publications:
   WAG in Conformance Control of CO₂ Floods,” *Canadian Energy Technology and Innovation*,
   Volume 1, No. 4, 2013.
   With No Matrix Porosity Using Fractal Discrete Fracture Networks,” *SPE Reservoir Evaluation &

Books: 1
Book Chapters: 4
Journal articles: 27
Conference Proceedings: 42
Patents: 1
Invited Lecturers: 21
Short Courses: 66

Scientific and Professional Society Membership/Offices:
Member of the Society of Petroleum Engineers SPE, American Inst. of Chemical Engineers AIChE

Honors and Awards:
- George K. Hickox Jr. Development Professor Faculty Fellow 2011
- Halliburton Faculty Fellow 2005

Professional Activities:
- Chairman Joint SPE-AAPG Applied Technology Workshop on Naturally Fractured Reservoirs,
  October 4 -6, 2010, Vail, CO.
- Chairman SPE Applied Technology Workshop on Naturally Fractured Reservoirs, January 26 –
  27, 2006, Houston, TX.
- SPE Primer Book Series, Committee Member and Author, 2003 – current
**Name:** Jerome J. Schubert, P.E.  
**Academic Rank:** Associate Professor (full time)

**Education**
- May 1999  Ph.D. in Petroleum Engineering, Texas A&M University, College Station, TX
- December 1995  M.Eng. in Petroleum Engineering, Texas A&M University, College Station, TX
- May 1978  B.S. in Petroleum Engineering, Texas A&M University, College Station, TX

**Professional Experience**
- Aug 94 to present  Texas A&M University, Dept. of Petroleum Engineering, College Station, TX
  - 09/2010 – present  Associate Professor
  - 01/2004-09/2010  Assistant Professor
  - 09/2003-12/2003  Senior Lecturer
  - 08/1994-09/2003  Lecturer
- Oct 90 to Aug 94  Senior Engineer and Lead Instructor, University of Houston/Victoria, Petroleum Training Institute, Victoria, TX
- Apr 89 to May 90  Assistant Controller, H. S. Sizemore and Son Co., Inc., Corpus Christi, TX
- Jul 82 to Feb 87  Drilling Engineer, Enron Oil and Gas, Corpus Christi, TX
- Jun 78 to Jun 82  Drilling Engineer, Pennzoil Company, Houston, TX

**Undergraduate and Graduate Courses Taught:**
- Drilling Courses

**Professional Memberships and Committees**
- Member of Society of Petroleum Engineers (SPE)
- Member of American Society for Engineering Education (ASEE)
- Member of American Association of Drilling Engineers (AADE)
- Member of International Association of Drilling Contractors (IADC)
- Member of American Society of Mechanical Engineers (ASME)
- Member of the Journal of Petroleum Technology Editorial Committee (2009 to present)
- Member of the IODP Environment Protection and Safety Panel (2006 to present)
- Member of the IADC WellCAP Review Panel (1996 to present)
- Member of the IADC Well Control Committee (1996 to present)
- Member of the IADC Training Committee (1998 to present)
- Member of the IADC Underbalanced Drilling Committee (2002 to present)

**Honors and Awards**
- Recipient of the 2013 TIPRO 15 Best Petroleum Engineers
- SPE Distinguished Member
- Holder of the Larry Cress ’76 Faculty Fellowship
- Full member of Sigma XI – The Scientific Research Society
- Member of Pi Epsilon Tau – The National Honor Society for Petroleum Engineers
- The SMD JIP received the Hart’s Special Meritorious Engineering Award. I received a certificate as a member of the design team

**Select Publications**
3. *Zhaoguang Yuan; Jerome Schubert; Catalin Teodoriu’ "Cement Failure Probability Analysis in Water Injection Well", Accepted pending revision Journal of petroleum science and engineering,

Books: 2
Book Chapters: 5
Journal Articles 14
Patents: 3
Conference Papers: 61

Graduate students graduated:
MS/Meng: 45
Ph.D: 9

Industry Short Courses
- Accompanied and helped Halliburton instructors with 5 day short course/field trip (An Unvarnished Look at the Oilfield) for 25 students 4 of the last 6 years.
- Offshore Drilling for (Oxonoco brought 7 engineers from Nigeria to Houston)
- Directional Drilling (Oxonoco brought 7 engineers from Nigeria to Houston)
- Managed Pressure Drilling (Oxonoco brought 7 engineers from Nigeria to Houston)
- Underbalanced Drilling (Oxonoco brought 7 engineers from Nigeria to Houston)
- Halliburton Directional Drilling Short Course
- Advanced and Emerging Drilling Technology (NExT – Venezuela)
- Well Planning I (NExT – Venezuela)
- Short course in UBD for Bison Energy Partners
- Offshore Drilling for Pemex
- Deep Trek Deep Drilling Training Course
- Review for the Principles and Practices Exam
- Basic Well Control
- SMD Basic Technology
- SMD Well Control
- Workshop on Underbalanced Drilling
- Workshop on Multilateral and Extended Reach Wells
- Served as Subject Matter Expert on Fundamentals of Well Control (interactive course developed by Techno Media, Schlumberger IPM and NExT)
Name: Catherine Landeck. Sliva  

Academic Rank: Senior Lecturer (part time)

Degrees: B.S. Petroleum Engineering, Texas A&M University, 1980

Professional experience:

Texas A&M University, College Station, Texas  
Harold Vance Department of Petroleum Engineering  
January 1, 2013-present, senior lecturer of petroleum engineering

BlueRock Energy Capital, Houston, Texas  
2002 - present, President and CEO

Range Resources Corporation (formerly Domain Energy), Houston, Texas  
1998 - 2000, Senior Vice President

Domain Energy Corporation (formerly Tenneco Ventures), Houston, Texas  
1996 - 1998, Executive Vice President

Tenneco Ventures Corporation (a subsidiary of Tenneco Gas), Houston, Texas  
1990 - 1996, Director

General Atlantic Resources, Houston, Texas  
1989 - 1990, District Acquisitions Engineer

Tenneco Oil Exploration and Production, Houston, Texas  
1980 - 1989, Senior Petroleum Engineer

Undergraduate and Graduate Courses Taught:  
PETE 403 Petroleum Project Evaluation

Scientific and Professional Society Membership/Offices:  
Vice chairman of the Texas A&M University Petroleum Engineering Industry Board  
Independent Petroleum Association of America (IPAA), Society of Petroleum Engineers (SPE), Texas Alliance of Energy Producers, Texas Independent Producers and Royalty Owners Association (TIPRO), and the National Stripper Well Association (NSWA)
Name: Glenn M. Sliva                               Academic Rank: Senior Lecturer (part time)

Degrees: B.S. Petroleum Engineering, Texas A&M University, 1981

Professional experience:

Texas A&M University, College Station, Texas
Harold Vance Department of Petroleum Engineering
January 1, 2013-present, senior lecturer of petroleum engineering

Lone Cypress Engineering, Inc., Houston, Texas
1992 - present, President and Owner

Sanchez-O’Brien Oil & Gas Corp., Houston, Texas
1982 - 1991, Reservoir Engineering Manager

Cities Service Corporation, Houston, Texas
1981 - 1982, Engineer

Undergraduate and Graduate Courses Taught:
PETE 403 Petroleum Project Evaluation

Scientific and Professional Society Membership/Offices:
 Registered Professional Engineer - Texas PE 60921
 Member of the Society of Petroleum Engineers SPE, Society of Petroleum Evaluation Engineers, SPEE, and the Society of Professional Well Log Analysts, SPWLA, Houston Energy Finance
Name: Peter P. Valkó  
Academic Rank: Professor (full time)

Degrees:
Ph.D. equivalent Chemical Engineering, Novosibirsk Institute of Catalysis (Russian Acad.) 1981
M.S. equivalent Technical Math. University of Veszprem, Hungary, 1975
B.S. equivalent Chemical Engineering, Veszprem University, Hungary, 1973

Professional experience:
Texas A&M University, College Station, USA
    Harold Vance Department of Petroleum Engineering
    January 1, 2006 - present, tenured full professor of petroleum engineering
    January 1, 2001 – December 31, 2005, tenured associate professor of petroleum engineering
    September 1, 1993 – December 31, 2000, visiting associate professor and research scientist

Mining University Leoben, Austria
    1991-93 Research associate, Institute of Drilling and Production

MOL Plc, Budapest, Hungary
    Hungarian Hydrocarbon Institute,
    1989-91, Senior Research Scientist

Eötvös Loránd University, Budapest, Hungary
    Chemical Cybernetics laboratory
    1987-88, tenured associate professor
    1981-86 assistant professor

Institute of Catalysis of the (then USSR) Academy of Sciences, Novosibirsk, Russia
    1977-80, thesis scholar

Eötvös Loránd University, Budapest, Hungary
    Chemical Cybernetics laboratory
    1975-76 Teaching Assistant

Courses Taught at A&M:
    Undergraduate; (ENGR109 phased out); (PETE 414 phased out); (ENGR 212 Conservation Principles in Thermal-Fluid Sciences phased out); PETE 211 Petrophysics ; PETE 301 Numerical Methods in PETE ; PETE 314 Transport Processes in Petroleum Production ; PETE 324 Well Performance ; PETE 410 Well Completion and Stimulation;
    Graduate: PETE 629 Advanced Hydraulic Fracturing ; PETE 602 Well Stimulation ; PETE 689 Flow in Porous Media with Mathematica ; PETE 689 Conservation and Transport in Petroleum Engineering ; PETE 685 continuously;

Select Publications:


Books: 3  
Book Chapters: 6  
Journal articles: 55  
Patents: 2  
Conference Papers: 33

**Scientific and Professional Society Membership/Offices:**  
Member of the Society of Petroleum Engineers SPE

**Recent Honors and Awards:**  
- R.L. Whiting chair in Petroleum Eng, 2013 - Texas A&M Engineering Program  
- L.F. Peterson chair, 2009-2012, Dwight Look College, Texas A&M Engineering Program  
- ConocoPhillips fellow, 2006, Texas A&M Engineering Program  
- Outstanding Associate Editor Award, SPE Journal, 2008

**Other Recent Professional Activities:**  
**Service:**  
- Editorial Board Member, SPE Journal, 2003-  
- Texas A&M University, Dwight Look College of Engineering, Research Award Committee Member, 2013-present  
- Department Undergraduate Curriculum Committee Chair, 2012-present  
- Liaison of the Department for the Evans Library

**Reviewer:**  

**Industry Short Courses Taught:**  
- Hydraulic Fracturing, Design and Evaluation (US, Canada, Peru, Argentina, Norway, Venezuela)
Name: George W. Voneiff   Academic Rank: Professor of Engineering Practice (part-time)

Degrees:
M.S. Petroleum Engineering, Texas A&M University, 1992
B.S. Petroleum Engineering, Texas A&M University, 1983

Professional Experience:
Unconventional Resources, LLC, College Station, Texas, USA
   February 1, 2007 - Present, President & CEO
Texas A&M University, College Station, Texas, USA
   Harold Vance Department of Petroleum Engineering
   January 1, 2013 - Present, Professor of Engineering Practice
   January 1, 2007 – December 31, 2012, Senior Lecturer
MGV Energy Inc., Calgary, Alberta, Canada
   September 1997 – May 2006, President and COO
S.A. Holditch & Associates, Inc., College Station, Texas, USA
   October 1995 – September 1997, Manager of Technical Support
   January 1992 – September 1995, Senior Petroleum Engineer / Project Manager
Enserch Exploration Inc., Athens, Texas, USA
   July 1985 – December 1990, Petroleum Engineer
Enserch Exploration Inc., Dallas, Texas, USA
   January 1984 – June 1985, Associate Petroleum Engineer

Graduate Courses Taught:
   PETE 664 Deterministic Petroleum Economics and Reserves
   PETE 667 Probabilistic Petroleum Economics and Reserves

Selected Publications:
Journal articles: 2
Industry articles: 3
Conference Papers: 8

**Professional Society Membership:**
Member of the Society of Petroleum Engineers SPE

**Recent Honors and Awards:**
- 2005 Sproule Lifetime Achievement Award from the Canadian Society for Unconventional Gas
- 2005 Recipient of the #1 Company in the Aggie 100 Presented by the Texas A&M Mays Business School
- 2004 Finalist in the Ernst & Young Canadian Entrepreneur of the Year

**Other Recent Professional Activities:**
- Texas A&M Petroleum Department Advisory Board, 2007 - Present
- Texas A&M Energy Engineering Institute Advisory Board, 2011 – Present
Name: Robert A. Wattenbarger  

Academic Rank: Professor (full-time)

Degrees:  
Ph.D. Petroleum Engineering, Stanford University, 1967  
M.S. University of Tulsa, 1965  
B.S. University of Tulsa, 1958

Professional experience:  
Texas A&M University, College Station, USA  
Harold Vance Department of Petroleum Engineering  
1983-present, Professor of Petroleum Engineering

Scientific Software Corporation, Denver, Colorado  
Manager, executive, and developer of reservoir simulators  
1969 – 1983 Reservoir Engineer and Manager

Mobil Research Laboratory, Dallas, Texas  
Developed reservoir simulators  
1967 – 1969 Senior Researcher

Sinclair Oil Company, Tulsa, Oklahoma  
Evaluation of waterflooding; economic evaluation  
1963-1965, Reservoir Engineer

Oil Recovery Corporation, Tulsa, Oklahoma  
Evaluation of enhanced secondary recovery projects  
1961-1963, Reservoir Engineer

Mobil Oil Corp. U.S. and Colombia  
Various Petroleum Engineering positions  
1958-1961, Petroleum Engineer

Undergraduate and Graduate Courses Taught:  
PETE 301 Numerical methods; PETE 324 Gas engineering; PETE 603 Reservoir simulation; PETE 610 Thermal simulation; PETE613 Gas reservoir engineering; PETE 604 Advanced reservoir simulation

Selected Publications:  

Journal articles: 45
Books: 1
Book Chapters: 4
Conference Proceedings: 151

Scientific and Professional Society Membership/Offices:
Sigma Xi research society
Member of the Society of Petroleum Engineers SPE

Recent Honors and Awards:
Sigma Xi
Pi Epsilon Tau
Halliburton Professor Award of Excellence, 1984
Tenneco Teaching Achievement Award, 1986
Best Technical Paper, EGPC Conference, Cairo, 1996
Technical Editor, Ciencia, Tecnologia y Futuro
SPE Legion of Honor, 2000
Juan Hefferan Technical Paper Award, Mexico, 2002
Halliburton Faculty Fellow, 2003
Student SPE Faculty Excellence Award, 2003
SPE Reservoir Description and Dynamics Award, 2012

Other Recent Professional Activities:
Service:
Advisory Board, University of Alaska, Fairbanks
Society of Petroleum Engineers (53 year member)
SPE, Editorial Committee, member, 1968-70
SPE, Editorial Committee, chairman, 1969-70
SPE, Monograph Committee, member, 1968-70
SPE, Manpower Committee, 1986-88
SPE, Steering committee for Computer Forum, 1994

Industry Short Courses:
Applied Petroleum Engineering and Reservoir Simulation
Enhanced Oil Recovery: Techniques, Practices and Simulation
Reservoir Engineering for Shale Gas and Oil Resources
Economic Evaluation of Projects
Name: Ding Zhu, P.E.  

Academic Rank: Professor (full-time)

Education
Ph.D., Petroleum Engineering, The University of Texas at Austin, 1992
M.S., Petroleum Engineering, The University of Texas at Austin, 1988
B.S., Beijing University of Science & Technology, Beijing, China, 1982

Years of Service
Professor, Texas A&M University, 2013- current
Associate Professor, Texas A&M University, 2008-2013
Assistant Professor, Texas A&M University, 2004-2008

Other Experience
Research Scientist, The University of Texas at Austin, 2000 to 2004
Research Associate, The University of Texas at Austin, 1994-1999
Post Doctoral Fellow, The University of Texas at Austin, 1992-1993
Production Engineer, China National Offshore Oil Co., China, 1983-85
Mechanical Engineer, Beijing Oxygen Supply Co., China, 1982-83

Honors and Awards
- Outstanding Technical Editor, SPE Production and Facilities, Oct. 2007
- Chevron Faculty Fellow, College of Engineering, Texas A&M University, 2008-2009
- W. D. Von Gonten Faculty Fellowship, Petroleum Engineering, Texas A&M University, 2008
- The Texas A&M University Student Led Award for Teaching Excellence, 2008
- The Texas A&M University System Student Led Award for Teaching Excellence, 2009
- SPE Distinguished Achievement Award for Petroleum Engineering Faculty, 2010
- BP Teaching Excellence Award, College of Engineering, Texas A&M University, 2010-2011
- SPE Distinguished Lecturer, 2011-2012
- SPE Distinguished Member, 2011
- Association of Former Students College-Level Distinguished Teaching Award, College of Engineering, Texas A&M University, 2011-2012
- Outstanding Associate Editor, SPE Production and Facilities, 2012
- Teaching Excellency Award, Petroleum Engineering Department, Texas A&M University, 2013

Principal Publications

Books: 2
Book Chapters: 0
Conference Papers: 134
Invited Lectures: 36

**Scientific and Professional Societies**
Society of Petroleum Engineers (SPE), 1986 to present

**Institutional and Professional Service**
- SPE ATCE Technical Committee Chairman, Production Monitoring and Control, 2007; 2013
- SPE International Oil & Gas Conference and Exhibition Program Committee and Session Chair, 2006 and 2009, China
- SPE Young Professional and Education Day Workshop, Chairman 2006 and 2009, China
- SPE Education Colloquium in Asia Pacific; Program Committee, Malaysia, July 2006
- SPE Energy Information Committee, 2009 to present
- SPE Production and Facilities Journal, Associate Editor, 2008 to present
- Journal of Natural Gas Science and Technology, Technical Editor

**Professional Development Activities**
- SPE Student Section Faculty Advisor, Petroleum Engineering Department, Texas A&M University, 2006 - 2007.
- Graduate Study Committee member, Petroleum Engineering Department, Texas A&M University, 2004 – present
- Graduate Admission Committee Chair, Petroleum Engineering Department, Texas A&M University, 2009 - present
- Chinese Student Association in Petroleum Engineering, Faculty Advisor, 2007 to present
Appendix C – List of Current Female Students
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<th>Category</th>
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<td>Optimal Reservoir Management and Well Placement Under Geologic Uncertainty</td>
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<td>WALTRICH, PAULO JOSE</td>
<td>BARRUFET\FALCONE</td>
<td>Aug-12</td>
<td>Modeling and Optimization analysis of Heat Exchangers and Refrigeration Systems</td>
</tr>
<tr>
<td>XIE, JIANG</td>
<td>DATTA-GUPTA</td>
<td>Aug-12</td>
<td>Applications of Level Set and Fast Marching Methods in Reservoir Characterization</td>
</tr>
<tr>
<td>DU, SONG</td>
<td>KING</td>
<td>Dec-12</td>
<td>Multiscale Reservoir Simulation: Layer Design, Full Field</td>
</tr>
<tr>
<td>Name</td>
<td>Advisor</td>
<td>Graduation Date</td>
<td>Dissertation Title</td>
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<tr>
<td>FU, XUEBING</td>
<td>LANE</td>
<td>Dec-12</td>
<td>Pseudoization and Near Well Modeling</td>
</tr>
<tr>
<td>KANG, SUK SANG</td>
<td>DATTA-GUPTA</td>
<td>Dec-12</td>
<td>Enhanced Oil Recovery of Viscous Oil by Injection of Water-in-Oil Emulsion Made with Used Engine Oil</td>
</tr>
<tr>
<td>MOHAMED, IBRAHIM MOHAMED</td>
<td>NASRELDIN</td>
<td>Dec-12</td>
<td>Model Calibration, Drainage Volume Calculation and Optimization in Heterogeneous Fractured Reservoirs</td>
</tr>
<tr>
<td>RABIE, AHMED IBRAHIM</td>
<td>NASRELDIN</td>
<td>Dec-12</td>
<td>Formation Damage due to CO2 Sequestration in Saline Aquifers</td>
</tr>
<tr>
<td>RAHNEMA, HAMID</td>
<td>BARRUFET</td>
<td>Dec-12</td>
<td>Reaction of Calcite and Dolomite with In-Situ Gelled Acids, Organic Acids, and Environmentally Friendly Chelating Agent (GLDA)</td>
</tr>
<tr>
<td>SHEN, ZHENG</td>
<td>BECK</td>
<td>Dec-12</td>
<td>Combustion Assisted Gravity Drainage (CAGD): An In-Situ Combustion Method to Recover Heavy Oil and Bitumen from Geologic Formations using a Horizontal Injector/Producer Pair</td>
</tr>
<tr>
<td>YUAN, ZHAOGUANG</td>
<td>TEODORIU</td>
<td>Dec-12</td>
<td>Numerical Modeling of Cased-hole Instability in High Pressure and High Temperature Wells</td>
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<tr>
<td>ARODALI, MOJTABA</td>
<td>BARRUFET</td>
<td>May-13</td>
<td>The Effect of Cement Mechanical Properties and Reservoir Compaction on HPHT Well Integrity</td>
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<tr>
<td>AWOLEKE, OBADARE OLUSEGUN</td>
<td>HILL</td>
<td>May-13</td>
<td>Investigation of Hybrid Steam/Solvent Injection to Improve the Efficiency of the SAGD Process</td>
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<tr>
<td>EL-MONIER, IIHAM ABDALLAH</td>
<td>NASRELDIN</td>
<td>May-13</td>
<td>Dynamic Fracture Conductivity-An Experimental Investigation Based on Factorial Analysis</td>
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<tr>
<td>ELKATATNY, SALAH ELDIN MAHMOUD AHMED</td>
<td>NASRELDIN</td>
<td>May-13</td>
<td>A New Environmentally Friendly AL/ZR-Based Clay Stabilizer</td>
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<tr>
<td>HAGHSHENAS, ARASH</td>
<td>SCHUBERT</td>
<td>May-13</td>
<td>New Techniques to Characterize and Remove Water-Based Drilling Fluids Filter Cake</td>
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<td>A Robust Four-Fluid Transient Flow Simulator as an Analysis and Decision Making Tool for Dynamic Kill Operation</td>
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<tr>
<td>Name</td>
<td>Advisor</td>
<td>Graduation Date</td>
<td>Dissertation Title</td>
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<tr>
<td>HUANG, JIAN</td>
<td>GHASSEMI</td>
<td>May-13</td>
<td>Geomechanical Development of Fractured Reservoirs During Gas Production</td>
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<tr>
<td>NASRALLA, RAMEZ MASOUD AZMY</td>
<td>NASRELDIN</td>
<td>May-13</td>
<td>A Mechanism of Improved Oil Recovery by Low-Salinity Waterflooding in Sandstone Rock</td>
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<tr>
<td>SEHBI, BALJIT SINGH</td>
<td>DATTA-GUPTA</td>
<td>May-13</td>
<td>Performance Analysis &amp; Optimization of Well Production in Unconventional Resource Plays</td>
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<td>ARIAS, HENRY</td>
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<td>Aug-13</td>
<td>Use of Finite-element Analysis to Improve Well Cementing in HTHP Conditions</td>
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<tr>
<td>CHUN, KWANG HEE</td>
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<td>Aug-13</td>
<td>Thermo-Poroelastic Fracture Propagation Modeling with Displacement Discontinuity Boundary Element Method</td>
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<td>GONG, XINGLAI</td>
<td>MCVAY</td>
<td>Aug-13</td>
<td>Assessment of Eagle Ford Shale Oil and Gas Resources</td>
</tr>
<tr>
<td>MIN, KYOUNG SUK</td>
<td>GHASSEMI</td>
<td>Aug-13</td>
<td>Numerical Modeling of Hydraulic Fracture Propagation Using Thermo-hydro-mechanical Analysis with Brittle Damage Model by Finite Element Method</td>
</tr>
<tr>
<td>NOYNAERT, SAMUEL FRANS</td>
<td>HOLDITCH</td>
<td>Aug-13</td>
<td>AIMR (Azimuth and Inclination Modeling in Realtime): A Method for Prediction of Dog-Leg Severity based on Mechanical Specific Energy</td>
</tr>
<tr>
<td>SAFARIFOROSHANI, REZA</td>
<td>GHASSEMI</td>
<td>Aug-13</td>
<td>Thermo-hydro-mechanical Analysis of Fractures and Wellbores in Petroleum/Geothermal Reservoirs</td>
</tr>
<tr>
<td>SAYED, MAHAMMED ALI IBRAHIM</td>
<td>NASRELDIN</td>
<td>Aug-13</td>
<td>Stimulation of Carbonate Reservoirs Using a New Emulsified Acid System</td>
</tr>
<tr>
<td>YANG, DAEGIL</td>
<td>BLASINGAME</td>
<td>Aug-13</td>
<td>A Simulator with Numerical Upscaling for the Analysis of Coupled Multiphase Flow and Geomechanics in Heterogeneous and Deformable Porous and Fractured Media</td>
</tr>
<tr>
<td>ZHANG, YANBIN</td>
<td>KING</td>
<td>Aug-13</td>
<td>Dynamic Reservoir Characterization Using Complex Grids Based on Streamline and Fast Marching Methods</td>
</tr>
<tr>
<td>ZHOU, YIJIE</td>
<td>KING</td>
<td>Aug-13</td>
<td>Improved Upscaling &amp; Well Placement Strategies for Tight Gas Reservoir Simulation and Management</td>
</tr>
<tr>
<td>Name</td>
<td>Advisor</td>
<td>Graduation Date</td>
<td>Dissertation Title</td>
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<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>FREEMAN, CRAIG MATTHEW</td>
<td>BLASINGAME</td>
<td>Dec-13</td>
<td>Study of Multi-Scale Transport Phenomena in Tight Fas and Shale Gas Reservoirs</td>
</tr>
<tr>
<td>LIMPASURAT, AKKHARACHAI</td>
<td>FALCONE</td>
<td>Dec-13</td>
<td>Artificial Geothermal Energy Potential of Steam-flooded Heavy Oil Reservoirs</td>
</tr>
<tr>
<td>MA, XIAODAN</td>
<td>GILDIN</td>
<td>Dec-13</td>
<td>Integrated hydraulic fracture placement and design optimization in unconventional gas reservoirs</td>
</tr>
<tr>
<td>OETH, CASSANDRA VONNE</td>
<td>HILL</td>
<td>Dec-13</td>
<td>Acid Fracture Simulation, Solution of Detailed Diffusion, Convection, and Reaction Components</td>
</tr>
<tr>
<td>OUYANG, LIANGCHEN</td>
<td>ZHU</td>
<td>Dec-13</td>
<td>Theoretical and Numerical Stimulation of Non-Newtonian Fluid Flowing Propped Fractures</td>
</tr>
<tr>
<td>WANG, YUHE</td>
<td>KILLOUGH</td>
<td>Dec-13</td>
<td>Techniques of High Performance Reservoir Simulation for Unconventional Challenges</td>
</tr>
<tr>
<td>WATANABE, SHINGO</td>
<td>DATTA-GUPTA</td>
<td>Dec-13</td>
<td>Stochastic and Deterministic Inversion Methods for History Matching and Production and Time-Lapse Seismic Data</td>
</tr>
<tr>
<td>ZHANG, QI</td>
<td>ZHU</td>
<td>Dec-13</td>
<td>Numerical Dash Based Study of Spent Acid Blockage Damage in Acidizing Gas Wells</td>
</tr>
</tbody>
</table>
IFP (Petroleum Engineering)/Texas A&M Reservoir Geoscience Degree Requirements

This is a joint degree program offered by the Institut Francais du Pétrole (IFP) and Texas A&M University. This program is rigid in its coursework components and will include a research thesis (and one additional semester) if a student elects to pursue a M.S. degree. Admission to this degree program requires that the student be admitted (independently) by both IFP and Texas A&M University. Please note that an application must be submitted to each institution, and note that admission decisions are made separately. Most importantly, admission to one institution does not guarantee admission to the other institution.

COURSE REQUIREMENTS

**Semester 1 (Fall): Texas A&M University**

- TAMU-PETE 620 ...................... Fluid Flow in Petroleum Reservoirs ........ (IFP Transfer) 
- TAMU-PETEa,b ......................... See PETE options list ...................... (IFP Transfer) 
- TAMU-PETE 612 ...................... Unconventional Oil and Gas .............. (IFP Transfer) 
- TAMU-GEOL 624 ..................... Carbonate Reservoirs ..................... (IFP Transfer)

**Session 2 (Spring): IFP (Paris) (January—April)**

- IFP-DEG 601 ............................ Well Testing and Interpretation ............ (TAMU transfer) 
- IFP-EXP 601 ............................. Well Logging ........................................ (TAMU transfer) 
- IFP-DEG 602 ............................. Production Mechanisms ..................... (TAMU transfer) 
- IFP-EXP 604 or EXP 606 .......... XXXXXXXXX

**Session 3 (Summer): IFP (Paris) (April—July)**

- IFP-DEG 603 ............................ Reservoir Simulation ......................... (TAMU transfer)

**Options**

- IFP-EXP 605 ............................ Reservoir Characterization Field Case  
- IFP-EXP 602 ............................. Clastic Reservoirs and Management of Heterogeneities  
- IFP-DEG 604 ............................. Well Design and Well Performances  
- IFP-EXP 603 ............................. Fractured Reservoirs  
- IFP-DEG 606 ............................. Advanced Reservoir Simulation

**Semester 4 (Fall): Texas A&M University**

- TAMU-PETEd ........................... Petroleum Economics/Production Evaluation  
- TAMU-PETEb ........................... See PETE options list  
- TAMU-PETEb ........................... See PETE options list  
- TAMU-GEPL Electiveb .......... See GEPL options list (can also select PETE Elective)

**Seminar**

PETE 681 (Seminar) .................................................................................................... No Credit

On-campus (College Station) students are required to take seminar each semester that it is offered.

Total hours required for Master of Engineering degree (IFP-G option) ................... 36 min

Total hours required for Master of Science degree (IFP-G option) ........................... 32 min

(The M.S. in Petroleum Engineering requires an acceptable research thesis, where this work is supervised by an advisory committee. The M.S. option for this program will likely require at least one additional semester to complete the research thesis.)

a. PETE 665 (Petroleum Reservoir Engineering) is required for students without a bachelor's degree in Petroleum Engineering.

b. Optional courses selected with guidance from the TAMU/PETE Graduate Advisor.

c. The course combination of Reservoir Simulation (DEG 603) and Reservoir Characterization...
Field Case (EXP 605) is required for students in the IFP/Texas A&M Reservoir Geoscience Degree Program.

d. A course that includes Petroleum Economics/Property Evaluation is required.

NOTES
1. The Memorandum of Agreement (MOA) between IFP and Texas A&M University permits a maximum of 12 hours of transfer courses from IFP, where these courses are specified in the IFP sequence given above. An official transcript from IFP is required prior to returning for the second fall semester, and this document must be sent directly from IFP to the International Admissions office at Texas A&M University.
2. The Memorandum of Agreement (MOA) between IFP and Texas A&M University requires that the Texas A&M degree be the first degree awarded.
3. All M.Eng. students in Petroleum Engineering at Texas A&M University are required to:
   a. Prepare a summary report on a technical topic that has been approved by the student's advisory committee. This report is typically the topic of the student's final examination.
   b. Successfully complete a final examination that usually consists of a technical presentation made to the student's advisory committee.
4. All M.S. students in Petroleum Engineering at Texas A&M University are required to:
   a. Prepare an appropriate research thesis, where this thesis is supervised by the student's advisory committee.
   b. Successfully complete a final examination/defense on the student's research thesis.
5. These degree requirements are a supplement to the Texas A&M University Graduate Catalog.

FALL SEMESTER COURSE OPTIONS (Petroleum Engineering/Texas A&M University)

- TAMU-PETE 602.................Well Stimulation
- TAMU-PETE 606.................EOR Methods—Thermal
- TAMU-PETE 609.................Enhanced Oil Recovery Processes
- TAMU-PETE 617.................Petroleum Reservoir Management
- TAMU-PETE 618.................Modern Petroleum Production
- TAMU-PETE 621.................Petroleum Development Strategy
- TAMU-PETE 622.................Exploration and Production Evaluation
- TAMU-PETE 623.................Waterflooding
- TAMU-PETE 630.................Geostatistics
- TAMU-PETE 631.................Petroleum Reservoir Description
- TAMU-PETE 632.................Data Integration for Petroleum Reservoirs
- TAMU-PETE 661.................Drilling Engineering
- TAMU-PETE 662.................Production Engineering
- TAMU-PETE 663.................Formation Evaluation and the Analysis of Reservoir Performance
- TAMU-PETE 664.................Petroleum Project Evaluation and Management
- TAMU-PETE 665.................Petroleum Reservoir Engineering
- TAMU-PETE 666.................Conservation Theory and Applications in Petroleum Engineering
- TAMU-PETE 685.................Problems (3 hrs maximum)

These are courses that are typically offered in the Fall semester. Students will be permitted to take other PETE courses (if available), as well as PETE 689 (Special Topics in...). All full-time students are also required to register for PETE 681 (Seminar—1 hour/week) each semester. These hours are not credited to the degree.

FALL SEMESTER COURSE OPTIONS (Geology and Geophysics/*Texas A&M University)

- TAMU-GEOL 624.................Carbonate Reservoirs
- TAMU-GEOP 421.................Petroleum Seismology I (Undergraduate course)
- TAMU-GEOP 611.................Geomechanics
- TAMU-GEOL 628.................Basin Architecture

* Graduate courses offered by the Department of Geology and Geophysics vary considerably from year to year. Other courses may be available at the graduate and undergraduate levels. Two upper division undergraduate courses (3XX or 4XX) in Geology or Geophysics are permitted for graduate credit.
IFP (Business)/Texas A&M Joint Degree Program
Degree Requirements

This is a joint degree program offered by the Institut Francais du Pétrole (IFP) and Texas A&M University. As this is a unique degree program, the course requirements are specified for each semester (or session). Admission to this degree program requires that the student be admitted (independently) by both IFP and Texas A&M University. Please note that an application must be submitted to each institution, and that admission decisions are made separately. Most importantly, admission to one institution does not guarantee admission to the other institution.

COURSE REQUIREMENTS

<table>
<thead>
<tr>
<th>Semester 1 (Fall): Texas A&amp;M University</th>
<th>HOURS</th>
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<tbody>
<tr>
<td>TAMU-PETE 620.......................Fluid Flow in Petroleum Reservoirs</td>
<td>12 min</td>
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<td>TAMU-PETE Elective*..............See PETE options list</td>
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<tr>
<td>TAMU-BUS Elective .................See BUS options list</td>
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</tr>
<tr>
<td>TAMU-BUS Elective .................See BUS options list</td>
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</tr>
<tr>
<td>* PETE 661, 662, 663, 664, and 665 is required for students without a bachelor's degree in Petroleum Engineering.</td>
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</tr>
</tbody>
</table>

Sessions 2 and 3 (Spring/Summer): IFP (Paris)

- IFP-Reservoir Engineering .................................(TAMU transfer)
- IFP-Upstream Economics .................................(TAMU transfer)
- IFP-Downstream Economics .......................(TAMU transfer)
- IFP-Refining ...............................................(TAMU transfer) ..........12 max (transfer)
- IFP-Capital Budgeting
- IFP-Financial Management
- IFP-Petroleum Economic Geography
- IFP-Linear Programming
- IFP-Corporate Management
- IFP-Econometrics
- IFP-Multivariate Data Analysis
- IFP-Strategic Management

Semester 4 (Fall): Texas A&M University

- TAMU-PETE 603.......................Advance Reservoir Engineering I (Reservoir Simulation)
- TAMU-PETE Elective ...............See PETE options list
- TAMU-BUS Elective .................See BUS options list
- TAMU-BUS Elective .................See BUS options list

Seminar

PETE 681 (Seminar) ................................................................................................................... No Credit

- On-campus (College Station) students are required to take seminar each that it is offered.

Total hours required for Master of Engineering degree (IFP-B option) ...............36 min

IFP (Business)/Texas A&M Joint Degree Program
Degree Requirements (continued)

NOTES

Mailing Address: 3116 TAMU
3116 TAMU
College Station, TX 77843-3116
Web - http://www.pe.tamu.edu

Graduate Program Office
401W Richardson Building
College Station, TX  77843-3116
Tel. 979.845.2877
Fax 979.845.1307
1. The Memorandum of Agreement (MOA) between IFP and Texas A&M University permits a maximum of 12 hours of transfer courses from IFP, where these courses are specified in the IFP sequence given above. An official transcript from IFP is required prior to returning for the second fall semester, and this document must be sent directly from IFP to the International Admissions office at Texas A&M University.

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3. All M.Eng. students in Petroleum Engineering at Texas A&M University are required to:
   a. Prepare a summary report on a technical topic that has been approved by the student's advisory committee. This report is typically the topic of the student's final examination.
   b. Successfully complete a final examination that usually consists of a technical presentation made to the student's advisory committee.

4. These degree requirements are a supplement to the Texas A&M University Graduate Catalog.

**FALL SEMESTER COURSE OPTIONS** (Petroleum Engineering/Texas A&M University)

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>TAMU-PETE 606</td>
<td>EOR Methods--Thermal</td>
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<tr>
<td>TAMU-PETE 608</td>
<td>Well Logging Methods</td>
</tr>
<tr>
<td>TAMU-PETE 609</td>
<td>Enhanced Oil Recovery Processes</td>
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<td>TAMU-PETE 617</td>
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<tr>
<td>TAMU-PETE 618</td>
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<td>TAMU-PETE 621</td>
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<td>TAMU-PETE 622</td>
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<td>Waterflooding</td>
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<td>TAMU-PETE 630</td>
<td>Geostatistics</td>
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<td>TAMU-PETE 631</td>
<td>Petroleum Reservoir Description</td>
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<td>Data Integration for Petroleum Reservoirs</td>
</tr>
<tr>
<td>TAMU-PETE 661</td>
<td>Drilling Engineering</td>
</tr>
<tr>
<td>TAMU-PETE 662</td>
<td>Production Engineering</td>
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<tr>
<td>TAMU-PETE 663</td>
<td>Formation Evaluation and the Analysis of Reservoir Performance</td>
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<td>TAMU-PETE 664</td>
<td>Petroleum Project Evaluation and Management</td>
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<td>TAMU-PETE 665</td>
<td>Petroleum Reservoir Engineering</td>
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<tr>
<td>TAMU-PETE 666</td>
<td>Conservation Theory and Applications in Petroleum Engineering</td>
</tr>
<tr>
<td>TAMU-PETE 685</td>
<td>Problems (3 hrs maximum)</td>
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</table>

These are courses that are typically offered in the Fall semester. Students will be permitted to take other PETE courses (if available), as well as PETE 689 (Special Topics in...).

**COURSE OPTIONS** (Graduate School of Business/Texas A&M University)

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>TAMU-MGMT 655</td>
<td>Survey of Management</td>
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<tr>
<td>TAMU-MKTG 621</td>
<td>Survey of Marketing</td>
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<tr>
<td>TAMU-FINC 645/IBUS 645</td>
<td>International Finance</td>
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<tr>
<td>TAMU-MKTG 677/IBUS 677</td>
<td>Multinational Marketing Management</td>
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<td>TAMU-MGMT 679/IBUS 678</td>
<td>International Business Policy</td>
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<tr>
<td>TAMU-MGMT 610</td>
<td>Business and Public Study</td>
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<td>TAMU-ECON 629</td>
<td>Microeconomic Theory I</td>
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<tr>
<td>TAMU-ECON 636</td>
<td>Macroeconomic Theory I</td>
</tr>
<tr>
<td>TAMU-BUS 6XX</td>
<td>Optional courses in Business*</td>
</tr>
</tbody>
</table>

* Optional courses may be taken in the Lowry Mays College and Graduate School of Business. Optional courses must be approved in advance by the Graduate Advisor in the Department of Petroleum Engineering (Texas A&M University) and the Program Advisor in the IFP Business Program.
# International Petroleum Management Program (IPM certificate)

**COURSE REQUIREMENTS**

<table>
<thead>
<tr>
<th>Petroleum Engineering Course Requirements:</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required: PETE and other engineering courses</td>
<td>18 hours</td>
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</table>

**International Petroleum Courses: (Non-PETE Coursework)**

<table>
<thead>
<tr>
<th>Non-PETE Coursework (Business Courses Required for IPM Program)</th>
<th>18 hours</th>
</tr>
</thead>
</table>

As part of this Master of Engineering Program, the Mays Business School will award the degree candidate a **Certificate in International Petroleum Management**. To qualify for this certificate the student must complete at least 18 semester hours of coursework in Mays Business School from the following course sequence:

- **Foundation (12 hours):**
  - ACCT 640: Accounting Concepts and Procedures I
  - INFO 660: Introduction to Contemporary Manufacturing Management
  - FINC 635: Financial Management for Non-Business
  - MGMT 655: Survey of Management
  - MKTG 621: Survey of Marketing

- **Electives (6 hours):**
  - FINC 645/IBUS 645: International Finance
  - INFO 635: Global Information Systems
  - INFO 667: Logistics and Distribution Management
  - MGMT 658: Managing Projects
  - MGMT 667: Multinational Enterprises
  - MGMT 678/IBUS 678: International Management
  - MGMT/IBUS 679/IBUS 679: International Business Policy
  - MKTG 677/IBUS 677: Multinational Marketing Management
  - IBUS 489/689: Special Topics in International Business Areas

Any variation in this course sequence in the College of Business must be approved by the IPM Program Coordinator in Mays Business School.

**Seminar**

PETE 681 (Seminar) .............................................................. No Credit

On-campus (College Station) students are required to take seminar when offered.

**Total hours required for Master of Engineering degree (IPM option) ................. 36 hours**

**Administrators for the program:**

Dr. I. Yucel Akkutlu, IPM Director Petroleum Engineering
Dr. Julian Gaspar, IPM Director Mays Business School

---

Mailing Address:
3116 TAMU
College Station, TX 77843-3116
Web - http://www.pe.tamu.edu

Graduate Program Office:
401W Richardson Building
College Station, TX 77843-3116
Tel. 979.845.2877
Fax 979.845.1307
Appendix G – Fast Track Degree Program
If you plan to pursue graduate studies in engineering, Fast Track can help you take the lead. With Fast Track, you can begin graduate studies at the end of your junior year and may complete both your B.S. (bachelor of science) and M.S. (master of science) or M.E. (master of engineering) degrees within five years.

So, if you are committed to earning a master’s degree from the Harold Vance Department of Petroleum Engineering at Texas A&M University, this program speeds up the process.

How Fast Track Works

The Basics

Most participating departments in the College of Engineering have streamlined their programs for Fast Track participants by substituting specific graduate courses for selected undergraduate offerings. Students take from 1 to possibly 4 of these 600-level courses during their senior year, fulfilling undergraduate elective requirements while earning graduate credits through 'credit-by-exam.'

As a graduate student, the student will complete the rest of the graduate courses, and complete a thesis in the case of an M.S. (thesis option) degree, in 12 months.

Like the other departments in the College of Engineering, the Harold Vance Department of Petroleum Engineering sets its own grade and exam requirements for earning dual credits. The department also establishes the maximum number of credit hours allowed for acceleration. To balance your academic load, we recommend taking one graduate-level course each semester during your last full year as an undergraduate student.

The Advantages

• Participate earlier in graduate studies
• Identify research opportunities in your chosen discipline sooner
• Receive dual credits for B.S. and M.S./M.E. degrees by up to 4 courses

The Requirements

• Student must finish junior year of study with a cumulative GPA of 3.5 or above
• Student needs to be approved by the undergraduate advisor
• Graduate office will review the application for admission to graduate program
• Student can only begin taking approved graduate courses during the senior year
• Maximum of two graduate courses per semester in the senior year
• Student needs to take GRE during/before the winter break of the senior year
Allowable Course Substitutions:

<table>
<thead>
<tr>
<th>Undergraduate Course</th>
<th>Graduate Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PETE 401</td>
<td>PETE 611</td>
</tr>
<tr>
<td>PETE 410</td>
<td>PETE 662</td>
</tr>
<tr>
<td>PETE 405</td>
<td>PETE 661</td>
</tr>
<tr>
<td>PETE 403</td>
<td>PETE 664</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fast-Track Master’s Degree Program</th>
<th>M.E.</th>
<th>M.S. (thesis option)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of hours required for degree</td>
<td>36 hours</td>
<td>32 hours</td>
</tr>
<tr>
<td>Completion of 2 or 4 graduate courses before graduation with B.S. degree and receiving credit “by exam” for same (or similar) undergraduate courses</td>
<td>12 hours (4 courses)</td>
<td>12 hours (4 courses)</td>
</tr>
<tr>
<td>Completion of 2 additional senior electives before graduation with B.S. degree</td>
<td>6 hours (2 courses)</td>
<td>6 hours (2 courses)</td>
</tr>
<tr>
<td>Hours to be completed after graduation with a B.S. degree</td>
<td>18 hours (6 courses)</td>
<td>14 hours (2 courses plus a thesis)</td>
</tr>
<tr>
<td>Estimated time required to receive Master’s degree after graduation with a B.S. degree</td>
<td>9 months or 2 semesters</td>
<td>Approximately 1 year, depending on when the thesis is completed</td>
</tr>
<tr>
<td>Texas A&amp;M residency requirement</td>
<td>None</td>
<td>9 hours</td>
</tr>
</tbody>
</table>

If you are currently a junior and would like to take advantage of this Fast-Track Master’s Degree Program for the Harold Vance Department of Petroleum Engineering, please set up an appointment with Dr. Bryan Maggard at bryan.maggard@pe.tamu.edu.
Ph.D Qualifying Examination in Petroleum Engineering

**Purpose:** The purpose of the Ph.D qualifying examination is to ensure that all Petroleum Engineering doctoral students advancing to candidacy have sufficient background in three primary areas viz. drilling, production and reservoir engineering.

**Timing:** The Ph.D qualifying examination will be offered once a year, normally in the second or third week of September. All doctoral students completing their first year in the department are required to take the qualifying examination.

**Format of the Examination:** The PhD qualifying examination will consist of three written exams, each in the areas of Reservoir Engineering, Production Engineering, and Drilling Engineering. Material covered in the qualifying examination will be from the following books.

- **Production Engineering:** *Petroleum Production Systems* by M. J. Economides, A. D. Hill, and C. Ehlig-Economides, Prentice Hall.
- **Drilling Engineering:** *Applied Drilling Engineering*, by Bourgoyne, Chenever, Millheim, and Young

All examinations will be OPEN book. Each of the three written examinations will last two hours. Students must pass all three examinations. A student scoring 70% or more passes the examination in that area of specialization. A student scoring 60-70% will be given a ‘conditional pass’. The student will be asked to take a remedial course in the subject area. This class will not be counted towards the student’s degree plan. A student scoring less than 60% will be asked to repeat the examination in the subject area when it is offered next time.

A two member committee will set the examination and also evaluate the examination papers. The chair of the committee in each subject area will be a member of the graduate committee. He/she will select another faculty member in the subject area to form the two member committee.

**Pass:** A student receiving a pass may continue in the doctoral program. If the student is serving as a GAR or GAT they may have their stipend increased to the PHD level with approval of their supervisor.

**Conditional Pass:** A student receiving a conditional pass must take a course in the subject area and receive a grade of A or B. Upon successful competition the student will be issued a pass for that subject area of the qualifying exam. The course used for the qualifying exam pass may not be used for graduate degree plan credit. A grade of C or below will be considered a failure for the exam and the student will be removed from the doctoral program.

**Failure:** A student failing the qualifying examination will be allowed a second attempt. A student will retake only the examination in the subject area(s) that he/she failed. If the student fails on the second attempt the student will be dismissed from the PHD Program. A student must pass ALL sections of the QE. If a student fails any subject area twice then the student has failed the QE and will be dismissed.

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Fax 979.845.1307
Registration Number: A registration number will be given to each candidate, which he/she will write on the examination paper. The student will not write his/her name or ID number on the examination paper.

Ph.D. students are encouraged to take PETE 661 (Drilling Engineering), PETE 662 (Production Engineering), and PETE 665 (Reservoir Engineering), or equivalent courses, as part of their first year study to prepare for the Exam.
Appendix I – Graduate Courses Offered and Syllabi
Graduate Course Descriptions

602. Well Stimulation. (3-0). Credit 3. Design and analysis of well stimulation methods, including acidizing and hydraulic fracturing; causes and solutions to low well productivity. **Prerequisite:** Approval of graduate advisor.

603. Advanced Reservoir Engineering I. (3-0). Credit 3. Petroleum reservoir simulation basics including solution techniques for explicit problems. **Prerequisite:** Approval of graduate advisor.

604. Advanced Reservoir Engineering II. (3-0). Credit 3. Advanced petroleum reservoir simulation with generalized methods of solution for implicit problems. **Prerequisites:** PETE 603; approval of graduate advisor.

605. Phase Behavior of Petroleum Reservoir Fluids. (3-0). Credit 3. Pressure, volume, temperature, composition relationships of petroleum reservoir fluids. **Prerequisite:** Approval of graduate advisor.

606. EOR Methods-Thermal. (3-0). Credit 3. Fundamentals of enhanced oil recovery (EOR) methods and applications of thermal recovery methods. **Prerequisites:** PETE 323; approval of graduate advisor.

608. Well Logging Methods. (3-0). Credit 3. Well logging methods for determining nature and fluid content of formations penetrated by drilling. Development of computer models for log analysis. **Prerequisite:** Approval of graduate advisor.

609. Enhanced Oil Recovery Processes. (3-0). Credit 3. Fundamentals and theory of enhanced oil recovery; polymer flooding, surfactant flooding, miscible gas flooding and steamflooding; application of fractional flow theory; strategies and displacement performance calculations. **Prerequisites:** PETE 323; approval of graduate advisor.

610. Numerical Simulation of Heat and Fluid Flow in Porous Media. (3-0). Credit 3. Various schemes available for the numerical simulation of heat and fluid flow in porous media. Application to hot water and steam flooding of heavy oil reservoirs and to various geothermal problems. **Prerequisites:** PETE 604; approval of instructor or graduate advisor.

611. Application of Petroleum Reservoir Simulation. (3-0). Credit 3. Use of simulators to solve reservoir engineering problems too complex for classical analytical techniques. **Prerequisites:** PETE 400 and 401; approval of graduate advisor.

613. Natural Gas Engineering. (3-0). Credit 3. Flow of natural gas in reservoirs and in well bores and gathering systems; deliverability testing; production forecasting and decline curves; flow measurement and compressor sizing. **Prerequisites:** PETE 323 and 324; approval of graduate advisor.

616. Engineering Near-Critical Reservoirs. (3-0). Credit 3. Identification of reservoir fluid type; calculation of original gas in place, original oil in place, reserves and future performance of retrograde gas and volatile oil reservoirs. **Prerequisite:** PETE 323, 400, 401; approval of graduate advisor.
617. Petroleum Reservoir Management. (3-0). Credit 3. The principles of reservoir management and application to specific reservoirs based on case studies presented in the petroleum literature. Prerequisites: Approval of graduate advisor.

618. Modern Petroleum Production. (3-0). Credit 3. An advanced treatment of modern petroleum production engineering encompassing well deliverability from vertical, horizontal and multilateral/multi branch wells; diagnosis of well performance includes elements of well testing and production logging; in this course the function of the production engineer is envisioned in the context of well design, stimulation and artificial lift. Prerequisite: Approval of graduate advisor.

620. Fluid Flow in Petroleum Reservoirs. (3-0). Credit 3. Analysis of fluid flow in bounded and unbounded reservoirs, wellbore storage, phase redistribution, finite and infinite conductivity fractures; dual-porosity systems. Prerequisites: PETE 323; approval of graduate advisor.

621. Petroleum Development Strategy. (2-3). Credit 3. Applications of the variables, models and decision criteria used in modern petroleum development. The case approach will be used to study major projects such as offshore development and assisted recovery. Both commercial and student-prepared computer software will be used during the lab sessions to practice methods. Prerequisites: PETE 403; approval of graduate advisor.

622. Exploration and Production Evaluation. (2-3). Credit 3. Selected topics in oil industry economic evaluation including offshore bidding, project ranking and selection, capital budgeting, long-term oil and gas field development projects and incremental analysis for assisted recovery and acceleration. Prerequisites: PETE 403; approval of graduate advisor.

623. Waterflooding. (3-0). Credit 3. Design, surveillance and project management of water floods in reservoirs. Prerequisites: PETE 323; approval of graduate advisor.

624. Rock Mechanic Aspects of Petroleum Reservoir Response. (3-0). Credit 3. Reservoir rocks and their physical behavior; porous media and fracture flow models; influence of rock deformability, stress, fluid pressure and temperature. Prerequisites: PETE 604; approval of graduate advisor.

625. Well Control. (3-0). Credit 3. Theory of pressure control in drilling operations and during well kicks; abnormal pressure detection and fracture gradient determination; casing setting depth selection and advanced casing design; theory supplemented on well control simulators. Prerequisites: PETE 411; approval of graduate advisor.

626. Offshore Drilling. (3-0). Credit 3. Offshore drilling from fixed and floating drilling structures; directional drilling including horizontal drilling; theory of deviation monitoring and control. Prerequisites: PETE 411; approval of graduate advisor.
628. **Horizontal Drilling.** (3-0). Credit 3. Changing a wellbore from vertical to horizontal; long- and short-radius horizontal wells; bottom hole assemblies for achieving and maintaining control of inclination and direction; drilling fluids; torque and drag calculations; transport of drilled solids. **Prerequisites:** PETE 411; approval of graduate advisor.

629. **Advanced Hydraulic Fracturing.** (3-0). Credit 3. Physical principles and engineering methods involved in hydraulic fracturing; an advanced treatise integrating the necessary fundamentals from elasticity theory, fracture mechanics and fluid mechanics to understand designs, optimization and evaluate hydraulic fracturing treatments including special topics such as high permeability fracturing and deviated well fracturing. **Prerequisite:** Approval of graduate advisor.

630. **Geostatistics.** (3-0). Credit 3. Introductory and advanced concepts in geostatistics for petroleum reservoir characterization by integrating static (cores/logs/seismic traces) and dynamic (flow/transport) data; variograms and spatial correlations; regionalized variables; intrinsic random functions; kriging/cokriging; conditional simulation; non-Gaussian approaches. **Prerequisites:** Introductory course in statistics or PETE 322; approval of graduate advisor.

631. **Petroleum Reservoir Description.** (3-0). Credit 3. Engineering and geological evaluation techniques to define the extent and internal character of a petroleum reservoir; estimate depositional environment(s) during the formation of the sedimentary section and resulting effects on reservoir character. **Prerequisites:** PETE 324 and 620; approval of graduate advisor.

632. **Physical and Engineering Properties of Rock.** (3-3). Credits 4. Physical and engineering properties of rock and rock masses including strength, deformation, fluid flow, thermal and electrical properties as a function of the subsurface temperature, in-situ stress, pore fluid pressure, and chemical environment; relationship of rock properties to logging, sitting and design of wells and structures in rock. **Prerequisite:** Approval of instructor of graduate advisor.

633. **Data Integration for Petroleum Reservoirs.** (3-0). Credit 3. Introduction and application of techniques that can be used to incorporate dynamic reservoir behavior into stochastic reservoir characterizations; dynamic data in the form of pressure transient tests, tracer tests, multiphase production histories or interpreted 4-D seismic information. **Prerequisites:** PETE 620 and STAT 601; approval of instructor or graduate advisor.

634. **Petroleum Reservoir Modeling and Data Analysis.** (3-0). Credit 3. Introduction methods for modeling and integration of reservoir data required to apply these methods; emphasizes the integration of geological information into these models.

648. **Pressure Transient Testing.** (3-0). Credit 3. Diffusivity equation and solutions for slightly compressible liquids; dimensionless variables; type curves; applications of solutions to buildup, drawdown, multi-rate, interference, pulse and deliverability tests; extensions to multiphase flow; analysis of hydraulically fractured wells. **Prerequisites:** PETE 324 and 620; approval of graduate advisor.
661. **Drilling Engineering.** (3-0). Credit 3. Introduction to drilling systems: wellbore hydraulics; identification and solution of drilling problems; well cementing; drilling of directional and horizontal wells; wellbore surveying abnormal pore pressure, fracture gradients, well control; offshore drilling, underbalanced drilling.

662. **Production Engineering.** (3-0). Credit 3. Development of fundamental skills for the design and evaluation of well completions, monitoring and management of the producing well, selection and design of article lift methods, modeling and design of surface facilities.

663. **Formation Evaluation and the Analysis of Reservoir Performance.** (3-0). Credit 3. Current methodologies used in geological description/analysis, formation evaluation (the analysis/interpretation of well log data), and the analysis of well performance data (the design/analysis/interpretation of well test and production data); specifically, the assessment of field performance data and the optimization of hydrocarbon recovery by analysis/interpretation/integration of geologic, well log, and well performance data. Prerequisite: Approval of instructor or graduate classification.

664. **Petroleum Project Evaluation and Management.** (3-0). Credit 3. Introduction to oil industry economics, including reserves estimation and classification, building and using reservoir models, developing and using reservoir management processes, managing new and mature fields, and investment ranking and selections.

665. **Petroleum Reservoir Engineering.** (3-0). Credit 3. Reservoir description techniques using petrophysical and fluid properties; engineering methods to determine fluids in place, identify production-drive mechanisms, and forecast reservoir performance; implementation of pressure-maintenance schemes and secondary recovery. Prerequisite: Approval of instructor or graduate classification.

666. **Conservation Theory and Applications in Petroleum Engineering.** (3-0). Credit 3. Includes formulation, modeling, and interpretation of drilling fluid systems, production systems, tracer testing, hydraulic fracturing, EOR/water flooding, polymer flooding, compositional simulation, thermal recovery, and coal-bed methane production; Mathematics as the symbolic/numeric computing platform.

681. **Seminar.** Credit 1 each semester. Study and presentation of papers on recent developments in petroleum technology. Prerequisite: Approval of graduate advisor.

685. **Directed Studies.** Credit 1 to 12 each semester. Offered to enable students to undertake and complete limited investigations not within their thesis research and not covered in established curricula. Prerequisites: Graduate classification; approval of instructor or graduate advisor.

689. **Special Topics in.** Credit 1 to 4. Special topics in an identified area of petroleum engineering. May be repeated for credit. Prerequisite: Approval of instructor or graduate advisor.
691. **Research.** Credit 1 or more each semester. Advanced work on some special problem within field of petroleum engineering. Thesis course. *Prerequisite:* Approval of committee or graduate advisor.

692. **Professional Study.** Credit 1 to 12. Approved professional study or project. May be taken more than once but not to exceed 6 hours of credit towards a degree. *Prerequisite:* Approval of graduate advisor.
PETE 602 – Well Stimulation

Instructor: H.A. Nasr-El-Din, Professor, Texas A & M University

HOURS: T, Th: 9:35-10:50 AM, Room 302

TEXT: Several text books will be used, including, but not limited to:

- Petroleum production Systems, Economides et al., 1993
- Acidizing Fundamentals, Williams et al., 1979
- Hydraulic Fracturing, SPE Reprint Series, 1990
- Reservoir Stimulation, Economides and Nolte, 3rd Ed., 2000
- Well Construction, Economides et al., 1998
- Multilateral Wells, Hill et al., 2008
- Reservoir Formation Damage, Civan, 2000
- Recent Advances in Hydraulic Fracturing, Gidley et al., 1989

GRADING: Homework 40%
          Project    30%
          Final Exam 30%

Work during the semester will consist of homework assignments, a class project, and a final exam. Homework must be turned to me at the start of the class at which it is due.

SUBJECT MATTER:
The course is designed for engineers who deal with well performance enhancement. The course will go through various techniques that can be used to enhance productivity of oil and gas wells. This is followed by overview of acid and hydraulic fracturing, matrix treatments for carbonate and sandstone formations. Issues related to candidate selection, treatment design, selection of acid additives, lab testing, acid placement, QA/QC, job execution, and treatment evaluation will be discussed in detail. The course will end with introducing new technologies for carbonate and sandstone acidizing. Field cases will be given to highlight problems and how lab testing was used to find cost effective solutions to these problems.
COURSE OUTLINE:

Introduction
- Mineralogy of oil and gas reservoirs
- Well types based on function
- Well types based on completion
- Matrix versus fracture acidizing
- Formation damage issues

Acid Types and their Reaction with Various Rocks

Carbonates – Chemistry Issues
- Inorganic and organic acids
- Reaction kinetics
- Acid Retarders:
  - Emulsified acids
  - In-situ gelled acids
  - Viscoelastic surfactant-based acids
  - In-situ generated acids
  - Chelates as stimulation fluids

Carbonates – Physics Issues
- Acid flow in carbonate rocks
- Wormhole patterns
- Optimum injection rate
- Modeling of matrix acidizing

Sandstone Formations – Chemistry Issues
- Chemistry and mineralogy of clays and feldspars
- Mud acids and their reactions with silica and silicates
- Retarded HF-based acids
- Chelating agents
- Impact of mineralogy on acid selection
- Field cases

Sandstone Formations – Physics Issues
- Flow of HF-based acids in sandstone rocks
- Models to predict acid propagation in sandstones
- Impact of acidizing on rock strength

Acid Additives
- Criteria used for selecting acid additives
- Corrosion inhibitors
- Corrosion inhibitors for organic acids
- Corrosion inhibitors for CRA
- Iron control agents
- Hydrogen sulfide scavengers
- Low-surface tension surfactants
- Drag reducing agents
- Mutual solvents
- Scale inhibitors
- Anti-sludge agents
- Clay Stabilizers
- Damage due to acid additives

**Reaction Kinetics**
- Methods to measure reaction rate
- Surface reaction kinetics
- Mass transfer kinetics
- Impact of additives
- Effect of clays
- Temperature effects

**Acid Placement Techniques**
- Bull heading
- Drill pipe
- Coiled tubing
- Methods to extend CT reach in long horizontal wells
- Entry into various laterals in multilateral wells
- Field cases

**Acid Fracturing**
- What is acid fracturing?
- Candidate selection
- Fluid selection
- Rock and fluid properties
- Lab testing before the job
- Fracture conductivity
- Field testing
- Simulation
- Job execution
- Field examples

**Hydraulic Fracturing**
- What is hydraulic fracturing?
- Rock mechanics
- Proppant characteristics
- Fluid selection
- Lab and field testing
- Methods to control proppant flow back
- Damage due to polymer residue
- Field cases

**ADA Policy Statement: (Texas A&M University Policy Statement)**
The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the UCC by the Department of Student Life. The policy Statement was forwarded to the Faculty Senate for information.

The Americans with Disabilities Act (ADA) is a federal antidiscrimination 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 that you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the
Koldus Building, or call 845-1637.

**Coursework Copyright Statement: (Texas A&M University Policy Statement)**

Suggested for Inclusion in Your First Day Handout or Syllabus

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, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyright-ed, 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, and writings, 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/](http://www.tamu.edu/aggiehonor/).
Instructor:

Instructor: Dr. Robert Wattenbarger Office: RICH 619
Lecture: MWF 8:00-9:00 a.m. RICH 302 (see schedule)
Office Hours: tba (or by appointment)
Phone: (979) 845-0173
e-mail: bob.wattenbarger@pe.tamu.edu

Texts:

1. PETE 603 notes, chapters 1-8 [“Class Notes”]
2. Chapter 11 of SPE Gas Reservoir Engineering by Lee & Wattenbarger [see “Class Notes”]
3. SPE Monograph 13, Reservoir Simulation

Reference Materials:

1. Course materials for this semester (including old exams, etc) are located in the Shares folder at:

   Y:\ Classes\pete603

2. Plus other handouts in class.

Basis for Grade:

Homework, including special project .........................25%
Exams A & B .............................................................40%
Exam C .................................................................25%
Class Participation/attitude/Pop Quizzes .......................10%
total = 100%

Grade Cutoffs: (Percentages)

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

Policies and Procedures:

1. Students are expected to attend class every session.
2. Students are expected to take notes
3. Policy on Grading
   a. It shall be the general policy for this course that homework, quizzes, and exams shall 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 exams 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 which, while possibly correct, but cannot be followed, will be considered incorrect — and will not be considered for a grade change.
   c. Grades assigned to homework problems will not be considered for regrading.
   d. If regrading is necessary, the student is to submit a letter to the instructor explaining the situation that requires consideration for regrading, the material to be regraded must be attached to this letter. The letter and attached material must be received within one week from the date returned by the instructor.

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. If a student comes to class after homework has been turned in and after class has begun, the student's homework will be considered late and given a grade of zero. 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. In particular, anyone caught cheating on an examination or collaborating on an assignment where collaboration is not specifically allowed will be removed from the class roster and given an F (failure grade) in the course.
Petroleum Engineering 605  
Phase Behavior of Petroleum Fluids  
Syllabus and Administration Procedures  
Spring 2014

Instructor: William D. McCain, Jr.  
Office: Room 501-N, Richardson Building  
Office Hours: TTr, 1:00 – 2:00 p.m.  
Office Phone: 979-845-8401, (Fax) 979-862-1272, (E-Mail) mccain@pe.tamu.edu

Text: Primarily handouts from literature and course notes. Some reading assignments in *The Properties of Petroleum Fluids*, 2nd Ed., McCain, PennWell (purchase not necessary but should have copy available). NOTE: Occasionally there will be a difference between the information in the book, the handouts from literature, or the information in the course notes or class discussions – if so, the information in the course notes or class discussion is the correct information.

Class Schedule:  
Lecture: TTr, 2:20 -3:35 p.m., room 302 RICH

Basis for grade:  
Class Exams (3) ........................................................... 54%  
Final Examination .................................................. 28%  
Homework ............................................................ 18%  
100%

Class Exams: Thursday 13 Feb 14, Thursday, 20 Mar 14, and Thursday 17 Apr 14

Final Exam: Wednesday 7 May 14, 1-3 pm, Room 302 RICH.

Americans with Disabilities Act (ADA) Policy Statement  
The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the University Curriculum Committee by the Department of Student Life. The policy statement was forwarded to the Faculty Senate for information.

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Academic Integrity Statement

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

All syllabi shall contain a section that states the Aggie Honor Code and refers the student to the Honor Council Rules and Procedures on the web http://www.tamu.edu/aggiehonor

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tr>
<td>14 Jan</td>
<td>Review of Organic Chemistry</td>
<td>Chap 1 PRF**</td>
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<tr>
<td>16 Jan</td>
<td>Petroleum Chemistry</td>
<td>MOD 1, Lec 1</td>
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<tr>
<td>21 Jan</td>
<td>Origin of Petroleum, Compositional Measurement</td>
<td>MOD 1, Lec 2</td>
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<tr>
<td>23 Jan</td>
<td>Petroleum Phase Behavior &amp; Five Fluids</td>
<td>Chap 2 &amp; 5 PRF</td>
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<td>28 Jan</td>
<td>The Five Petroleum Reservoir Fluids</td>
<td>MOD 2</td>
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<td>30 Jan</td>
<td>Compositional Gradients</td>
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<td>4 Feb</td>
<td>Properties of Black Oils, Reservoir fluid Studies</td>
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<td>11 Feb</td>
<td>Properties of Gas Condensates, Reservoir Fluid Studies</td>
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<tr>
<td>18 Feb</td>
<td>Properties of Gas Condensates, Reservoir Fluid Studies</td>
<td>MOD 6</td>
</tr>
<tr>
<td>20 Feb</td>
<td>Swelling Tests – Gas</td>
<td></td>
</tr>
<tr>
<td>25 Feb</td>
<td>Condensate Buildup Around Wellbores</td>
<td>MOD (no number)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lec part 1, part 2, part 3</td>
</tr>
<tr>
<td>27 Feb</td>
<td>Properties of Volatile Oils, Reservoir Fluid Studies</td>
<td>MOD 7 &amp; MOD 8</td>
</tr>
<tr>
<td></td>
<td>&amp; Swelling Tests, MMP Tests - Oil</td>
<td></td>
</tr>
<tr>
<td>4 Mar</td>
<td>Gas-Liquid Equilibria with K-Factors</td>
<td>Chap 12 PRF &amp; MOD 9</td>
</tr>
<tr>
<td>6 Mar</td>
<td>Sampling Gas Condensates and Volatile Oils</td>
<td>MOD 11-2</td>
</tr>
<tr>
<td>11 Mar</td>
<td>SPRING BREAK</td>
<td></td>
</tr>
<tr>
<td>13 Mar</td>
<td>SPRING BREAK</td>
<td></td>
</tr>
<tr>
<td>18 Mar</td>
<td>Compositional Material Balance – Vol Oil and Gas Cond</td>
<td>MOD 10</td>
</tr>
<tr>
<td>20 Mar</td>
<td>QUIZ 2</td>
<td>MOD 11</td>
</tr>
<tr>
<td>25 Mar</td>
<td>K-Factors – Vol Oil &amp; Gas Cond</td>
<td>MOD 12</td>
</tr>
<tr>
<td>27 Mar</td>
<td>Equations of State, A History</td>
<td>Chap 4 PRF &amp; MOD 12</td>
</tr>
<tr>
<td>1 Apr</td>
<td>Equations of State, Mixture Rules &amp; BIC</td>
<td>MOD 15</td>
</tr>
<tr>
<td>3 Apr</td>
<td>Gas-Liquid Equilibria with Equations of State</td>
<td>Chap 15 PRF</td>
</tr>
<tr>
<td>8 Apr</td>
<td>Gas-Liquid Equilibria with Equations of State</td>
<td>MOD 14</td>
</tr>
<tr>
<td>10 Apr</td>
<td>Single Carbon Number Groups Correlations</td>
<td>MOD 16</td>
</tr>
<tr>
<td>15 Apr</td>
<td>Splitting, i.e., Extending the Plus Fraction</td>
<td>MOD 17</td>
</tr>
<tr>
<td>17 Apr</td>
<td>Quiz</td>
<td>MOD 18</td>
</tr>
<tr>
<td>22 Apr</td>
<td>Grouping</td>
<td>MOD 19</td>
</tr>
<tr>
<td>24 Apr</td>
<td>“Tuning”</td>
<td></td>
</tr>
<tr>
<td>29 Apr</td>
<td>Redefined Day – Attend Friday Classes</td>
<td></td>
</tr>
<tr>
<td>7 May</td>
<td>FINAL EXAMINATION, 1-3 pm, Room 302 RICH</td>
<td></td>
</tr>
</tbody>
</table>

*There will be additional homework assignments; hand calculations, spreadsheet calculations, and paper reviews.

**The Properties of Petroleum Fluids, 2nd Edition
PETE 606
EOR Methods-Thermal Processes in Petroleum Engineering
Fall 2013

Instructor: Dr. Berna Hascakir
Office: Room 401N, Richardson Building
E-mail: berna.hascakir@pe.tamu.edu
Office Hours: Tuesday-Thursday 10:20 to 11:10
Class Schedule: MWF 10:20 to 11:10

Texts
- PETE 606 class notes
- Related technical papers

Grading Summary
Homework & Quizzes 40%
Mid-term Exams 30%
Final Exam 30%

Course Description
Fundamentals of thermal enhanced oil recovery methods in low API gravity oil reservoirs.

Course Outline
- Introduction
  - Unconventional Low API Gravity Oil Resources
    - Heavy Oil, Oil Shales, Tar Sands, Oil Sands
  - Thermal Enhanced Oil Recovery Processes
    - Current Thermal EOR Projects
    - History of Thermal EOR
- Heat transfer
  - Mechanisms of Heat Transfer
  - Thermodynamic Properties of Reservoir Fluids and Rocks
  - Heat Losses
- Hot-Water Drives
- Steam Injection
  - Steam Drives
  - Cyclic Steam Injection
  - Steam Assisted Gravity Drainage (SAGD)
- In-Situ Combustion
  - Dry Forward Combustion
  - Wet Combustion
  - Reverse Combustion
• Other Thermal Methods
  o Retort
  o Electrothermic Process
• Numerical and Analytical Modeling of Thermal EOR
  o Challenges
  o 1D, 2D, and 3D

Academic Integrity Statement and Policy

Aggie Code of Honor

"An Aggie does not lie, cheat, or steal or tolerate those who do."
For more information: http://www.tamu.edu/aggiehonor

ADA Policy Statement: (Texas A&M University Policy Statement)
Americans with Disabilities Act (ADA) Policy Statement

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the UCC by the Department of Student Life. The policy Statement was forwarded to the Faculty Senate for information.
The Americans with Disabilities Act (ADA) is a federal antidiscrimination 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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit 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, 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”
Instructor

Zoya Heidari, Ph.D.
Assistant Professor
Chevron Corporation Faculty Fellow in Petroleum Engineering
Texas A&M University
Harold Vance Department of Petroleum Engineering

Office: 401P Richardson
Telephone: (979) 847-8912
E-mail: zoya@pe.tamu.edu

Instructor Office Hours

Students are encouraged to use office hours during the semester. The instructor’s office hours are as follows:

Group office hours: Tuesdays and Thursdays 5:00 PM-6:00 PM
Location: 401P Richardson

Individual office hours: Tuesdays and Thursdays 6:00 PM-6:30 PM
Location: 401P Richardson

The instructor encourages all the students to attend group office hours to benefit from the discussions and learn from their peers. Distance learning students can join the discussions online.

Additional office hours can be scheduled in advance upon the request from students based on instructor’s availability.

E-Campus Course Website

All the homework assignments, lecture notes, and project assignments will be uploaded on the e-campus webpage designed for this course. Students are responsible to check their university e-mails and e-campus e-mails at least once a day after 6:00 PM for announcements and any required action for the course.
**Course Description**

The content of Well Logging Methods course is as follows:

- Introduction to well logging methods for determining nature and fluid content of formations penetrated by drilling. The application of well-log interpretation methods will be practiced for the following cases:
  - Core-log integration, rock typing, and resource assessment
  - Quantitative interpretation of well logs to estimate rock and fluid properties, including porosity, net pay thickness, fluid saturations, fluid type/density, volumetric/weight concentrations of minerals, and dynamic petrophysical properties such as permeability and saturation-dependent capillary pressure
  - Well-log interpretation in clay-free, shaly-sand, carbonate, and organic-shale formations
- Theory and physics of well-log measurements
- Development of computer models for well-log analysis

**Credit:** 3 hrs  
**Prerequisites:** Students are expected to have basic knowledge of petrophysics and Geology.

**Teaching Assistants**

Alvaro Aranibar  
E-mail: alvaroaranibar@pe.tamu.edu  
Office hours: TBA  
Location: Richardson 909 (Tentative)

Responsibilities of teaching assistants include:

- Helping students with conceptual and technical questions.
- Guiding students in homework and project assignments.
- Helping students in the preparation for exams.
- Training students for using a commercial Formation Evaluation software.

**Class/Laboratory Schedule**

<table>
<thead>
<tr>
<th>Section</th>
<th>Lecture</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>TR 8:00 AM – 9:15 AM (RICH 302)</td>
<td>TBD</td>
</tr>
<tr>
<td>700</td>
<td>TR 8:00 AM – 9:15 AM (RICH 302)</td>
<td>TBD</td>
</tr>
<tr>
<td>720</td>
<td>TR 8:00 AM – 9:15 AM (RICH 302)</td>
<td>TBD</td>
</tr>
</tbody>
</table>
Suggested References

- Introduction to Wireline Log Analysis, Baker Hughes CD.

References for Introduction to Petrophysics:


Additional Instructional Material

- The instructor will distribute the following material in the class:
  - Formation Evaluation Log Responses Poster, Baker Hughes, 2011.

Handouts and Class PowerPoint Presentations

PowerPoint presentations will be posted on the e-campus website in PDF format. The instructor will not print and distribute the PowerPoint presentations in the class.

Handouts including field examples will be distributed in the class.
Additional Reading Assignments and References

Additional reading assignments and references will be uploaded on the e-campus website under “References” folder.

Useful Websites

- Society of Petrophysicists and Well Log Analysts  
  http://www.spwla.org/  
- Schlumberger Oil Field Glossary  
  http://www.glossary.oilfield.slb.com/  
- Mnemonics Data Search  
  http://www.spwla.org/technical/curve-mnemonics  
- Log Interpretation Charts, Schlumberger  
- Log Interpretation Charts, Halliburton  

Course Objectives and Outcomes

At the end of the course, students will be able to:

- Understand the physics of nuclear, electrical resistivity, and acoustic measurements from openhole, cased hole, wireline, and LWD well logs
- Analyze the effect of static (e.g., porosity, volumetric concentration of shale, water saturation, and volumetric concentrations of mineral constituents) and dynamic (e.g., permeability and saturation-dependent capillary pressure) petrophysical properties on well logs
- Evaluate the quality of well logs
- Estimate petrophysical and compositional properties (e.g., porosity, water saturation, volumetric concentration of shale, volumetric concentrations of minerals, permeability, and saturation-dependent capillary pressure) using combined interpretation of well logs and core measurements in different formations such as clay-free, shaly-sand, carbonate, and organic-shale formations
- Estimate elastic properties of the formation using well logs
- Identify rock types for quantifying reservoir quality using well logs
- Make decisions for candidates for perforation and fracturing jobs based on combined interpretation of well logs and core data
- Use a commercial software (e.g., Interactive Petrophysics (IP) and Techlog) for well-log interpretation
Grading Policy

The distribution of the final grade will be as follow:

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight (%)</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework and Project Assignments</td>
<td>35</td>
<td>Thursdays before 11:00 PM</td>
</tr>
<tr>
<td>Class Contribution and quizzes</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>30</td>
<td>Tuesday, October 24, 2013 at 8:00 AM</td>
</tr>
<tr>
<td>Final Exam/Final Project</td>
<td>30</td>
<td>Monday, December 9, 2013 at 1:00 PM</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Grade Cutoffs: The regular university grading scale will be used in determining letter grades.
A: > 90%   B: 89.99% to 80%   C: 79.99% to 70%   D: 69.99% to 60%   F: < 59.99%

Course Policies

- **Class Attendance**: Students are expected to attend every session of the class. Always bring your logging charts, well logs, and a calculator to the class. There is always the possibility of having pop quizzes and solving examples of well-log interpretation in the class, which will not be repeated later.

- **Team Work and Individual Performance**: Collaboration on examinations and assignments is forbidden except when specifically authorized. See Policy on Academic Integrity. For additional information, visit [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor). We have two types of homework and project assignments; individual and group assignments. Individual assignments should be submitted individually. However, group project assignments are team exercises. Collaboration within teams is required; collaboration between teams is forbidden except when specifically authorized. Team reports will be assigned a team grade.

- **Teams**: Teams will be formed during the first week of the semester. Students can choose their team members themselves. The instructor suggests you to team up with students from different majors. Having a combination of on-campus and distance learning students in each team is also highly encouraged. There will be an end-of-term peer-evaluation of individual group members based on their contribution to group work and their collaboration with other group members.

- **Homework and Project Assignments**: Homework and project assignments will be uploaded on e-learning every other week on Thursdays. The deadline for the assignments will be in two weeks after uploading the assignment before 11:00 PM on the e-campus website. Homework assignments will be considered late if they are not turned in before 11:00 PM on the due date. **Late or not, all assignments must be turned in**. Late homework assignments should be e-mailed to the TA responsible for your section and the instructor should be carbon copied (CC) in that e-mail. The e-mailed/late assignments will only receive partial credit. 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.
• **Exams and pop quizzes:** The students who miss any of the exams will not be given any additional exam. The final grade will be re-distributed for the students who miss the midterm exam with valid excuses without including the exam that they missed. Valid excuses include only university-approved reasons in accordance with Texas A&M University Student Rules (see [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). Pop quizzes can be taken any time during lecture hours.

• **Laboratory Sessions:** All the laboratory sessions are optional. The purpose of Laboratory sessions is software training. The students will learn the fundamentals of Techlog during laboratory sessions.

• **Grading and Regrading:** The policies regarding grading and regarding of exams and homework and project assignments are as follows:
  a. It is the general policy for this class that homework and exams shall 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 GAT’s, or under the instructor’s direction and supervision, and the decision of the instructor is final.
  d. Only in very rare cases will exams 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.
  e. Work, which, while correct, cannot be followed, will be considered incorrect and will not be considered for a grade change.
  f. The request for homework and project regrading should be submitted to the instructor within one week from the date returned.
  g. If regrading is necessary for the exams, the student should submit a regrading request to the instructor within one week from the date returned.

• **University Regulations Concerning Attendance, Grades, and Scholastic Dishonesty:** Each student should review the University Regulations concerning attendance, grades, and scholastic dishonesty. In particular, anyone caught cheating on an examination or homework assignment will be removed from the class roster and given an F (failure grade) in the course. Please see **Appendix A** for more details about Academic Integrity Policy for this course.

• **Americans with Disabilities Act (ADA) Policy Statement (Texas A&M University 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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).

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- Aggie Code of Honor:

  An Aggie does not lie, cheat, or steal or tolerate those who do.
## Tentative Course Schedule*

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>DOW</th>
<th>Type</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/27/13</td>
<td>T</td>
<td>Lecture</td>
<td>Introduction to Well Logging, Course Policies</td>
</tr>
<tr>
<td></td>
<td>08/29/13</td>
<td>R</td>
<td>Lecture</td>
<td>Review on Petrophysics and Geology Concepts</td>
</tr>
<tr>
<td>2</td>
<td>09/03/13</td>
<td>T</td>
<td>Lecture</td>
<td>Quick-look well-log interpretation</td>
</tr>
<tr>
<td></td>
<td>09/05/13</td>
<td>R</td>
<td>Lecture</td>
<td>Quick-look well-log interpretation</td>
</tr>
<tr>
<td>3</td>
<td>09/10/13</td>
<td>T</td>
<td>Lecture</td>
<td>Logging environment</td>
</tr>
<tr>
<td></td>
<td>09/12/13</td>
<td>R</td>
<td>Lecture</td>
<td>Data quality control</td>
</tr>
<tr>
<td>4</td>
<td>09/17/13</td>
<td>T</td>
<td>Lecture</td>
<td>Caliper, tension, and temperature logs</td>
</tr>
<tr>
<td></td>
<td>09/18/13</td>
<td>W</td>
<td>Lab**</td>
<td>Introduction to Techlog</td>
</tr>
<tr>
<td></td>
<td>09/19/13</td>
<td>R</td>
<td>Lecture</td>
<td>GR Logs</td>
</tr>
<tr>
<td>5</td>
<td>09/24/13</td>
<td>T</td>
<td>Lecture</td>
<td>Spontaneous Potential (SP) logs</td>
</tr>
<tr>
<td></td>
<td>09/25/13</td>
<td>W</td>
<td>Lab**</td>
<td>Introduction to Techlog</td>
</tr>
<tr>
<td></td>
<td>09/26/13</td>
<td>R</td>
<td>Lecture</td>
<td>Density logs</td>
</tr>
<tr>
<td>6</td>
<td>10/01/13</td>
<td>T</td>
<td>Lecture</td>
<td>PEF logs</td>
</tr>
<tr>
<td></td>
<td>10/03/13</td>
<td>R</td>
<td>Lecture</td>
<td>Electrical resistivity logs, electromagnetic properties of rocks</td>
</tr>
<tr>
<td>7</td>
<td>10/08/13</td>
<td>T</td>
<td>Lecture</td>
<td>Examples on $S_w$ assessment, Introduction to Pickett Plot</td>
</tr>
<tr>
<td></td>
<td>10/10/13</td>
<td>R</td>
<td>Lecture</td>
<td>Invasion effects on well logs and annulus effect</td>
</tr>
<tr>
<td>8</td>
<td>10/15/13</td>
<td>T</td>
<td>Lecture</td>
<td>Midterm Exam</td>
</tr>
<tr>
<td></td>
<td>10/17/13</td>
<td>R</td>
<td>Lecture</td>
<td>Neutron porosity logs, gas and mineralogy effects</td>
</tr>
<tr>
<td>9</td>
<td>10/22/13</td>
<td>T</td>
<td>Lecture</td>
<td>Acoustic logs, Basic rock mechanics, Fluid substitution</td>
</tr>
<tr>
<td></td>
<td>10/24/13</td>
<td>R</td>
<td>Exam</td>
<td>Midterm Exam</td>
</tr>
<tr>
<td>10</td>
<td>10/29/13</td>
<td>T</td>
<td>Lecture</td>
<td>NMR logs</td>
</tr>
<tr>
<td></td>
<td>10/30/13</td>
<td>W</td>
<td>Lab**</td>
<td>Introduction to Techlog</td>
</tr>
<tr>
<td></td>
<td>11/31/13</td>
<td>R</td>
<td>Lecture</td>
<td>Pulsed neutron devices and spectroscopy</td>
</tr>
<tr>
<td>11</td>
<td>11/05/13</td>
<td>T</td>
<td>Lecture</td>
<td>Assessment of dynamic petrophysical properties, Conventional vs. new methods</td>
</tr>
<tr>
<td></td>
<td>11/07/13</td>
<td>R</td>
<td>Lecture</td>
<td>Lithology assessment based on well logs, Multi-mineral Analysis</td>
</tr>
<tr>
<td>12</td>
<td>11/12/13</td>
<td>T</td>
<td>Lecture</td>
<td>Well-log interpretation in shaly-sand formations</td>
</tr>
<tr>
<td></td>
<td>11/14/13</td>
<td>R</td>
<td>Lecture</td>
<td>Well-log interpretation in shaly-sand formations</td>
</tr>
<tr>
<td>13</td>
<td>11/19/13</td>
<td>T</td>
<td>Lecture</td>
<td>Well-log interpretation in organic-rich source rocks</td>
</tr>
<tr>
<td></td>
<td>11/21/13</td>
<td>R</td>
<td>Lecture</td>
<td>Rock typing techniques based on well logs</td>
</tr>
<tr>
<td>14</td>
<td>11/26/13</td>
<td>T</td>
<td>Lecture</td>
<td>Evaluation of thinly-bedded formations</td>
</tr>
<tr>
<td></td>
<td>11/28/13</td>
<td>R</td>
<td>Holiday</td>
<td>Thanks giving holiday, No classes</td>
</tr>
<tr>
<td>15</td>
<td>12/03/13</td>
<td>T</td>
<td>Lecture</td>
<td>Image logs, High-angle wells</td>
</tr>
<tr>
<td></td>
<td>12/05/13</td>
<td>R</td>
<td>Lecture</td>
<td>Reading day, No classes</td>
</tr>
<tr>
<td></td>
<td>12/09/13</td>
<td>M</td>
<td>Exam</td>
<td>Final Exam (1:00 PM – 3:00 PM)</td>
</tr>
</tbody>
</table>

* This course schedule is tentative and subject to change.

** All the laboratory sessions are optional. The purpose of Laboratory sessions is software training. The laboratory schedule is tentative and subject to change.
APPENDIX A: ACADEMIC INTEGRITY POLICY

Rationale – Why I Do What I Do?

Technical competence: I want you to be able to perform well technically as an engineer. I want each of you to be able to perform well individually, not just when you are working with your buddies. It is very unlikely that you and your buddies will end up working together. To remain employed and prosper in your career, you will have to perform individually. In addition to developing technically, deciding that you will not cheat will force you to develop self discipline and time management skills in order to get good grades, which will also help you immensely in your career.

Ethical competence: I want you to be ethically competent. While you may be able to succeed in the short term by being unethical, just as you may get good grades by cheating in school, long-term success can only be achieved with ethical behavior. Don’t think that cheating in school is different from being unethical in the workplace, or that once school is over you will change or won’t need to cheat anymore. If you cheat in school, you won’t think twice about padding your expense account. If you do that, then overstating reserves to increase your bonus won’t bother you. It’s not a big step from there to cooking the books of your company to inflate the value of your stock options. I don’t want any Aggies involved in the next Enron debacle, and it starts with cheating in school.

Fairness: Those who cheat have an unwarranted advantage over those who don’t. I want to be fair to those who don’t cheat.

The Aggie Honor Code: As a Texas A&M University faculty member, I am also bound by the Aggie Honor code, which includes that I will not tolerate those who cheat.

What I Will Do?
For the reasons above, and because I feel quite strongly about them,
1. I will do everything I reasonably can to prevent cheating. I don’t do everything I possibly can because this would be a full-time job.
2. Because I can’t do everything possible to prevent cheating, when I determine a cheating violation has occurred I will (a) report it through the Aggie Honor System Office (AHSO), and (b) punish to the full extent that I am able to.

What Constitutes Academic Dishonesty?
You may be surprised at what is considered academic dishonesty. For example,
• During an examination, looking at another student's examination or using external aids (for example, books, notes, calculators, conversation with others, or electronic devices) unless specifically allowed in advance by the instructor.
• Acquiring answers for any assigned work or examination from any unauthorized source. This includes, but is not limited to, using the services of commercial term paper companies, purchasing answer sets to homework from tutoring companies, and obtaining information from students who have previously taken the examination.
• Collaborating with other students in the completion of assigned work, unless specifically authorized by the instructor teaching the course.
• Knowingly allowing another to copy from one's paper during an examination or test. See http://aggiehonor.tamu.edu/Descriptions/ for a complete list.

Reporting an Academic Violation – What Happens?
• I will report the violation to the AHSO, regardless of the magnitude of the violation.
• The report is submitted online and includes (1) the details of the violation, (2) an election to handle autonomously or refer to the Honor Council, (3) specification of sanction, and (4) student acknowledgement of acceptance/rejection of violation and/or sanction.
• I will usually handle the first offense autonomously; e.g., I decide the sanction. My minimum sanction will usually be a one-letter-grade reduction in your course grade. The maximum sanction I can and will award is an F* (failure of the course and notation of “FAILURE DUE TO ACADEMIC DISHONESTY” on transcript until cleared by taking the Academic Honesty Remediation Course).
• I will usually include taking the Academic Honesty Remediation Course as part of the sanction. This is a three-class, one-month course on academic integrity. I will usually give you one semester to take the course. If you do not take the course by this time your grade will be changed to an F*.
• Importantly, you are now logged into the AHSO system. If there is a second violation, in any course, you will automatically go before the Honor Council, and you will likely be expelled from the university.
• Note that upper division students found guilty of a violation are ineligible to graduate with honors. I will treat students giving unauthorized help the same as students receiving unauthorized help.
• In all cases, you have the right to appeal to the AHSO.

Final Words
Please understand that none of this is personal. My desire is for academic integrity, regardless of who you are. I want you all to do well. I just want you to do it honestly. You will be a better engineer because of it.

You now know what I will do. Don’t claim ignorance or ask for a second chance if you are caught. I have given the consideration I will give by telling you in advance and in no uncertain terms what I will do so that you can make an informed decision about cheating.
PETE 609
Enhanced Oil Recovery Processes
Summer 2014

Instructor: Dr. Berna Hascakir
Office: Room 401N, Richardson Building
E-mail: berna.hascakir@pe.tamu.edu
Office Hours: TBD
Class Schedule: TBD

Texts
- PETE 609 class notes
- Related technical papers

Grading Summary
Homework & Quizzes 40%
Mid-term Exams 30%
Final Exam 30%

Course Description
Fundamentals and theory of enhanced oil recovery; polymer flooding, surfactant flooding, miscible gas flooding and steam flooding; application of fractional flow theory; strategies and displacement performance calculations.

Course Outline
1. Introduction
2. Microscopic Displacement of Fluids in a Reservoir
3. Displacement in Linear Systems
4. Macroscopic Displacement of Fluids in a Reservoir
5. Mobility-Control Processes
6. Miscible Displacement Processes
7. Chemical Flooding
8. Thermal Recovery
Academic Integrity Statement and Policy

Aggie Code of Honor

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

For more information: http://www.tamu.edu/aggiehonor

ADA Policy Statement: (Texas A&M University Policy Statement)

Americans with Disabilities Act (ADA) Policy Statement

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the UCC by the Department of Student Life. The policy Statement was forwarded to the Faculty Senate for information.

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If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu.

Coursework Copyright Statement: (Texas A&M University Policy Statement)

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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”
COURSE SYLLABUS

PETE 611 – Application of Petroleum Reservoir Simulation
Texas A&M University - Summer 2013

Instructor: Dr. Bryan Maggard
Office: 501-U RICH
Phone: (979) 845-0592
Email: maggard@pe.tamu.edu
Lecture: TR, 8:00-9:50 p.m., 319 RICH; and Web Based Distance Learning

COURSE DESCRIPTION

Use of simulators to solve reservoir engineering problems too complex for classical analytical techniques.

Course Outcomes: At the end of this course, students will be able to:
1. Explain reservoir simulation fundamentals - the underlying equations and the numerical techniques used to solve them.
2. Design a reservoir simulation model, construct the data set, execute the simulator, and view simulation results visually using post-processing software.
3. Plan and conduct the calibration of a reservoir simulation model.
5. Apply reservoir simulation technology to solve production and reservoir engineering problems in individual wells or patterns.
6. Apply reservoir simulation technology to solve production and reservoir engineering problems in entire fields or reservoirs.
7. Apply equation-of-state regression technology to construct a fluid model by matching laboratory PVT test data.
8. Apply compositional reservoir simulation to solve production and reservoir engineering problems.
9. Effectively present the results of an engineering study in a written report.

TEXTS

PETE 611 Web Site – Lecture Notes and Supplemental Papers from Literature

Optional Texts:

• Mattax and Dalton: Reservoir Simulation, SPE Monograph 13, 1990.

COURSE POLICIES

1. Work Quality: Neat, legible, systematic and complete presentation is required in assignments. Units (for example, Newton-meters) must be documented wherever appropriate, including table column titles and chart axes.

2. Grading System: The course will be graded as follows:

   Projects (Approx. 5-6)  75 %
   Homework (Approx. 5-6)  25 %

   No “extra credit” opportunities will be available after course grades are assessed.
3. **Academic Integrity**: There is no tolerance for cheating in any form.


   **Aggie Code of Honor**: “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 each project report or homework cover page there shall be printed and signed by the student(s):

   “On my(our) honor, as an Aggie(s), I(we) have neither given nor received unauthorized aid on this academic work.”

Collaboration on assignments is forbidden except when explicitly instructed. If you are not sure whether collaboration is allowed on a particular assignment, confer with the course instructor.

5. **Accommodation for Disabilities**:

   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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

6. **Accommodation for Religious Observance**:

   Texas HB256: “An institution of higher education shall excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused.”

   A sincere effort will be made to accommodate students’ needs for religious observance. Students are instructed to contact the instructor during the first week of class in order to make arrangements.

7. **Class Topics**:

<table>
<thead>
<tr>
<th>Week – First Class of Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1 – June 4</td>
<td>Course Introduction; Intro. to Conventional Simulation</td>
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<tr>
<td>2 – June 11</td>
<td>Intro. to Conv. Sim; Type Curve Matching</td>
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<tr>
<td>3 – June 18</td>
<td>History Matching</td>
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<td>4 – June 25</td>
<td>Scale-Up</td>
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<td>5 – July 2</td>
<td>Pseudo-Functions</td>
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<tr>
<td>6 – July 9</td>
<td>Modeling Well Performance / Coning</td>
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<tr>
<td>7 – July 16</td>
<td>EOS Compositional Fluid Models</td>
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<tr>
<td>8 – July 23</td>
<td>Compositional Simulation</td>
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<tr>
<td>9 – July 30</td>
<td>Introduction to Streamline Simulation</td>
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<tr>
<td>10 – August 6</td>
<td>Workshop – Project</td>
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<tr>
<td>11 – August 12</td>
<td>Last Project Due</td>
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UNCONVENTIONAL OIL AND GAS RESERVOIRS
PETE 612
Tentative Syllabus and Administrative Procedures
Fall 2013

Class Meetings: T, TH; 11:10 a.m. – 12:25 p.m., RICH 302
Instructor: Walter B. Ayers, Ph.D., CPG ayers@pe.tamu.edu RICH 401M
(979) 458-0721
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
TA: Yao Tian yao.tian@pe.tamu.edu

As we deplete conventional oil and gas reserves, “unconventional” energy resources are increasingly important to U.S. and international energy supplies. In 2009, coal beds, shales, and low-permeability (tight) sandstones, combined, accounted for 55% of the U.S. dry gas production (DOE/EIA-0383, 2011). That year, U.S. production of coalbed methane, exceeded 1.8 trillion cubic ft (Tcf), which was 9% of the total dry gas production (21 Tcf); tight sands produced 6.6 Tcf, and shales produced 5.0 Tcf of dry gas (DOE/EIA-0383, 2011). The US DOE/EIA (2012) estimates that, by 2035, unconventional reservoirs will account for 75% of the total US dry gas production of 26.3 Tcf, led by shales, which will account for 49% (13.6 Tcf) of the dry gas produced. Today, shale gas and oil projects are among the most active hydrocarbon plays in North America.

U.S. oil production grew approximately 6% from October 2011 through March 2012, largely due to increases in shale oil production from the Bakken and Eagle Ford Formations. For example, oil production from the Eagle Ford Shale accelerated from 36.6 million barrels in 2011, to 27.1 million barrels for the only the first four months of 2012, according to Texas Railroad Commission figures.

Internationally, there are tremendous unconventional hydrocarbon resources, including the heavy oil resources in Eastern Venezuela, Western Canada, and other areas, and we are beginning to evaluate and exploit these resources. Gas hydrates resources, although great, await development of technology that will lead to their economic production.

While resources of unconventional hydrocarbons are very large, project economics differ from conventional reservoirs, because the greater costs and the additional technology required for economic production from wells. Many unconventional reservoirs have low matrix permeability, and natural fractures may be necessary for economic production rates. Therefore, optimal development of unconventional reservoirs requires knowledge of the optimal drilling, completion 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) resources and economic significance (2) geologic occurrences, (3) controls on production rates, (4) drilling and completion practices, (5) reservoir management, and (6) present activity.


Text and Materials: There is no assigned textbook. Materials will be approximately 50 current reports, published texts, and papers. Reference materials and reading assignments will be handed out and/or placed in an ecampus folder. Lectures will be recorded and available in ecampus, and lecture slides will be posted for viewing.

Selected References:
Basis for Grades:

Team Report (includes, peer evaluations) ...................................................... 25 percent
Homework and Quizzes ................................................................................. 25 percent
Midterm Examination (Oct. 18 – 21); online ................................................ 25 percent
Final Examination (Friday, Dec. 6, 3 – 5 p.m.) (and online) ......................... 22 percent
Participation .................................................................................................. 3 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 (GUIDELINES – SUBJECT TO REVISION)

Working in teams, students will write reports on topics related to unconventional resource occurrences and development. Topics will be assigned by 20 September, and preliminary outlines and references are due 11 October. You will be given general outlines (guidelines) of topic to be covered. Reports will be submitted in both paper and digital formats, following either SPE or AAPG publication guidelines. Text of reports will be 15-20 double-spaced pages (Arial font, 11 or 12 point); tables and figures may be either embedded in the text or placed at the end, following the references. Use EndNote software for references. Reference papers used to prepare reports will be submitted as pdf files embedded in EndNote. All reports will be due by 5 p.m. on 3 December. Peer reviews will be submitted when you submit the reports. Also, reports will be posted on the share drive and will be available to all class members. Finally, as a homework assignment, each team will submit a “Class Homework Exercise” pertinent to their research topic; it will be graded as part of your team report, above.

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
The course will include lectures on unconventional reservoirs and reviews of basic petroleum geology concepts. The review material is presented as videos and slides of past lectures. Primary responsibility for the review topics will lie with the student. Your knowledge of lecture and review materials will be assessed with quizzes and exams.

REVIEW TOPICS
1. Petroleum Systems
2. Thermal maturation and hydrocarbon generation
3. Hydrology and biogenic gas
4. Geologic principles and time
5. Structural features
6. Hydrocarbon migration and trapping
7. Naturally fractured reservoirs
8. In-situ stress

LECTURE TOPICS
1. 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

2. Overview of Depositional and Petroleum Systems
   - Introduction to sedimentary depositional systems and petroleum systems concepts

3. Shale Reservoirs (Gas and Oil)
   - Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
   - Review of selected shale plays and activity
   - Drilling, completion, and stimulation methods
   - Water and environmental issues

4. Coalbed Gas
   - Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
   - Drilling, completion, and stimulation methods
   - Facilities, reservoir management, limitations on development, present activity
   - Water and environmental issues
UNCONVENTIONAL OIL AND GAS RESERVOIRS
Petroleum Engineering 612
Syllabus and Administrative Procedures
Fall 2013

5. Low-permeability (Tight) Sands
   - Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
   - Drilling, completion, and stimulation methods
   - Facilities, reservoir management, limitations on development, present activity

6. Heavy Oil
   - Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
   - Drilling, completion, and stimulation methods
   - Facilities, reservoir management, limitations on development, present activity
   - Environmental issues

7. Gas Hydrates
   - Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
   - Recovery methods
   - Limitations on development, present activity
   - Environmental issues

8. Gas Storage (Depending on Available Time)
   - Types and locations of gas storage reservoirs
   - Technical issues and terminology
   - Gas storage volumes and economics

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Instructor:
Instructor: Dr. Robert Wattenbarger Office: RICH 619
Lecture: MWF 8:00-9:00 a.m. RICH 302 (see schedule)
Office Hours: tba (or by appointment)
Phone: (979) 845-0173
e-mail: bob.wattenbarger@pe.tamu.edu

Texts:
1. Various ppt and pdf files [on web page]
2. Gas Reservoir Engineering by Lee & Wattenbarger
3. Fundamentals of Reservoir Engineering by Dake

Reference Materials:
1. Course materials for this semester (including old exams, etc) are located at:
   Shares/classes/PETE613_Wattenbarger/
2. Plus other handouts in class.
3. DL lectures will also be provided (see the DL technicians)

Basis for Grade:
Homework, including special project ................................. 15%
Special project ................................................................. 15%
Exams A & B ................................................................. 60%
Class Participation/attitude/Pop Quizzes ............................... 10%
total = 100%

Grade Cutoffs: (Percentages)
A: < 90    B: 89.99 to 80     C: 79.99 to 70    D: 69.99 to 60     F: < 59.99

Policies and Procedures:
1. Students are expected to attend class every session.
2. Students are expected to take notes
3. Policy on Grading
   a. It shall be the general policy for this course that homework, quizzes, and exams shall 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.
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   b. Work which, while possibly correct, but cannot be followed, will be considered incorrect — and will not be considered for a grade change.
   c. Grades assigned to homework problems will not be considered for regrading.
   d. If regrading is necessary, the student is to submit a letter to the instructor explaining the situation that requires consideration for regrading, the material to be regraded must be attached to this letter. The letter and attached material must be received within one week from the date returned by the instructor.
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. If a student comes to class after homework has been turned in and after class has begun, the student's homework will be considered late and given a grade of zero. 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. In particular, anyone caught cheating on an examination or collaborating on an assignment
where collaboration is not specifically allowed will be removed from the class roster and given an F (failure grade) in the course.

Course Description
This course includes basic equations, derivations and underlying principles used in reservoir engineering.

Topics to be covered:
- Gas properties
- Depletion behavior
- Depletion behavior – geo-pressured
- Well flow behavior – PSS
- Well test behavior – drawdown test
- Well testing – type curves
- Pseudo times
- Radial-linear-bilinear flow
- Dual porosity reservoirs
- Liquid Loading
- Condensate reservoirs
- Superposition
- Deconvolution
- Coalbed methane
- Shale gas

Prerequisites by Topic
- Differential and integral calculus.
- Ordinary and partial differential equations.
- Fluid dynamics and heat transfer.
- Reservoir fluid properties.
- Reservoir petrophysics.
- Well test analysis
- Reservoir simulation
Engineering Near-Critical Reservoirs
PETE 616
Spring 2014

Syllabus and Administrative Procedures

Instructor:
Dr. Maria A. Barrufet
Teaching Assistant: Karin Gonzalez

e-mail: maria.barrufet@pe.tamu.edu

Contact Information: 979.845.0314
Office: Rooms 407C Richardson Building
Office Hours: Tuesday and Friday 3:00 – 4:00 PM or by appointment

Course Description:


Identification of reservoir fluid type; calculation of original gas in place, original oil in place, reserves and future performance of retrograde gas and volatile oil reservoirs.

Prerequisites: PETE 323, PETE 400, PETE 401.

ACCESSING AND DOWNLOADING MATERIALS FROM LIBRARY (live tutorial for on-campus and distance-learning students)


Module 1: Overall Scope – Reservoir and Fluid Characterization

The big picture: Near Critical Reservoirs Characteristics. Characteristic Phase Diagrams for Hydrocarbon Fluids: Pressure, Specific Volume (or Density), Temperature and Compositional Relations. Classification of Reservoir Fluids Using Phase Diagrams, Compositions, Production, and PVT Data.

Module 2: Material Balance Equation and Introduction to Simulation

Module 3: Reservoir Simulation for Near Critical Fluids – Special Compositional Needs


The need for splitting the C7+ fraction. Behrens - Sandler and Whitson’s method.

Module 4: Compositional Gravitational Gradients - Condensate Banking – Well Deliverability Production Strategies

Equilibrium conditions under the influence of gravity.

Compositional gradients and conditions for significant compositional variation.

Condensate Banking Problems and Solutions: Effects of Reservoir Heterogeneity, Production Rates, and Pressures, Evaluating well deliverability in gas condensate reservoirs (analytical and simulation)

Module 5: Building a Fluid Model – Calibration of EOS

Use of PVTi – Processing Data and Generating a Fluid Model for ECLIPSE 300

Calibration of EOS parameters to constant composition expansion (CCE), Swelling tests, and/or constant volume depletion data (CVD).

Tuning to viscosity data.

Module 6: Compositional Reservoir Simulator – Processing Input and Output Files

Introduction to ECLIPSE 300 – Preparation of input files.


Evaluation of oil and gas in place from production data. Compositional Simulation and CVD-EOS approach (comparison with earlier exercise in course).

Module 7: Compositional Simulation – Special Features: Optimizing Oil Production Project

Using Eclipse 300.

Local Grid Refining. Relative Permeabilities as function of IFT.

Simulation and evaluation of depletion and gas cycling strategies: Volatile and Gas Condensate, examples. Production Controls: Scheduling/Restart Files. (Static Reservoir Model Provided).

- Extended and lumped compositional description
- Black oil and compositional model
- Evaluation of relative permeability models (Corey and IFT dependent)
- Local grid refining options (analysis of condensate banking, deliverability)
- Horizontal and vertical wells

Performance Evaluation

Participation – Discussions in Bulletin Board – Team work 10%

Paper Reviews and Homework leading to a final project 40%

Simulation Project- Maximum Oil Recovery Competition (Max recovery from a condensate field under technical & economic constraints) 50%

Class notes downloadable from E-Campus. Selected SPE and other electronically provided papers/chapters, resources.
GUIDELINES FOR PAPER REVIEW
It should take no more than one page to summarize a typical paper. Some papers may require more; use your own judgment. Learn to be concise and to state briefly the essential ideas communicated.

USUAL ORGANIZATION OF A REVIEW (adapted from Dr. John Lee)

- Authors, title. Use the SPE standard reference style. (You can find it in the SPE Guide to Publications, which is on the web at http://www.spe.org)
- Problem. Briefly, describe the problem the authors are trying to solve.
- Solution. Describe the solution the authors propose. Did they propose a specific method to recover additional oil, do they discuss data required, limitations, do they analyze performance? What is it?
- Value. Describe the value of the authors’ solution to the petroleum industry.
- Conclusions. Describe the conclusions the authors reached as a result of their analysis
- Approach. Describe what the authors did to validate their proposed solution.
- Limitations. List the limitations of the work. Is it applicable to only a certain type of reservoir or field?
- Application. How would you apply the knowledge provided in this paper?
- Critique. What questions did the authors leave unanswered? What could the authors have done to make the paper better?

OBJECTIVES FOR REVIEWING PAPERS IN THIS CLASS

- To learn how to learn from papers (harder than textbooks, but more important in the long run)
- To learn how to identify the really important ideas in papers
- To learn how to summarize ideas concisely
- To learn how engineers with vastly different points of view think and how they approach problems and their solutions

Academic Integrity Syllabus Statement

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____________________________
Signature of Student

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PETE 617 SYLLABUS

Course title Petroleum Reservoir Management
Session Spring 2013
Meeting times Monday/Friday 8:30a – 9:45a
Class location RICH 912B

Course Description and Prerequisites

Studies of the principles of reservoir management and application to specific reservoirs based on case studies presented in the literature and through subject matter expert lectures. Special attention to long term sustainability, key processes, ethics and changing management practices to facilitate reserves recovery optimization.

Prerequisite: While there is no prerequisite, it is assumed you have a basic understanding of petroleum engineering principles and basic economic evaluation skills.

Graduate classification.

Learning Outcomes or Course Objectives

The objectives of the course are for students to be able to:

1. Find and use scholarly information about reservoir management
2. Evaluate multidisciplinary contributions to reservoir management
3. Learn how to identify important integrated field management processes and practices
4. Learn how to summarize ideas concisely
5. Learn how integrated teams with different professional perspectives think, approach problems and decisioning

Instructor Information

Name Priscilla G. McLeroy, P.E.
Telephone number (979) 845-2907
Email address priscilla.mcleroy@pe.tamu.edu
Office hours By appointment and Mondays 11:30a – 1:30pm
Office location 916G Richardson Building

Primary Reference Materials

Papers: Selections and case studies on field project planning, implementation, surveillance, evaluation, modification, problems, and solutions. Most papers can be downloaded from the TAMU library system.

Books for Technical Review and Reference:
# Grading Policies & Scale

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Term Project &amp; Presentation</td>
<td>40%</td>
</tr>
<tr>
<td>Literature Reviews Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Class and Discussion Board Participation</td>
<td>20%</td>
</tr>
<tr>
<td>Innovation Contribution</td>
<td>20%</td>
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<tr>
<td><strong>Total</strong></td>
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<table>
<thead>
<tr>
<th>Grade</th>
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<tbody>
<tr>
<td>A</td>
<td>90-100%</td>
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<tr>
<td>B</td>
<td>80-89%</td>
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<tr>
<td>C</td>
<td>70-79%</td>
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<tr>
<td>D</td>
<td>60-69%</td>
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<tr>
<td>F</td>
<td>0-59%</td>
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## Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Class Format</th>
<th>Pre-Reading Topic</th>
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<tbody>
<tr>
<td>01/14/2013, M</td>
<td>Lecture - Overview</td>
<td>Reservoir, Reserves Management</td>
</tr>
<tr>
<td>01/18/2013, F</td>
<td>Lecture – System</td>
<td>Resource Management</td>
</tr>
<tr>
<td>01/25/2013, F</td>
<td>Lecture – Practices</td>
<td>Visualization, Conceptualization, Definition: Stage-Gating</td>
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<tr>
<td>01/28/2013, M</td>
<td>Guest Lecture – Dr John Sharry, Geoscientist, Amigos Energy Advisors</td>
<td>Geoscience Model</td>
</tr>
<tr>
<td>02/01/2013, F</td>
<td>Discussion Board (DB*)</td>
<td>Data Management</td>
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<tr>
<td>02/04/2013, M</td>
<td>DB</td>
<td>Synergy &amp; Scenarios</td>
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<td>02/08/2013, F</td>
<td>DB</td>
<td>Reservoir Model</td>
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<tr>
<td>02/11/2013, M</td>
<td>Guest Lecture – Dr Aquiles Rattia, Corporate Reserves VP, Repsol</td>
<td>Reserves Management</td>
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<tr>
<td>02/15/2013, F</td>
<td>DB</td>
<td>Production Optimization</td>
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<tr>
<td>02/18/2013, M</td>
<td>Guest Lecture – Dr Paul Papayaonou, SGG President</td>
<td>Economics &amp; Risk Management</td>
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<tr>
<td>02/22/2013, F</td>
<td>DB</td>
<td>Energy Policies – US and International</td>
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<tr>
<td>02/25/2013, M</td>
<td>DB</td>
<td>Example Case History - Mature Assets</td>
</tr>
<tr>
<td>03/01/2013, F</td>
<td>Guest Lecture – Dr Stephen Holditch, Director, Texas A&amp;M Energy Institute</td>
<td>Future Policies Regarding Unconventionals</td>
</tr>
<tr>
<td>03/04/2013, M</td>
<td></td>
<td>Case Histories - Arctic Assets</td>
</tr>
<tr>
<td>03/08/2013, F</td>
<td></td>
<td>Case Histories - Deepwater Assets</td>
</tr>
<tr>
<td>03/18/2013, M</td>
<td></td>
<td>Case Histories – Carbonate Assets</td>
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<tr>
<td>03/22/2013, F</td>
<td></td>
<td>Project Preparation (working in 4 person teams)</td>
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<tr>
<td>03/25/2013, M</td>
<td></td>
<td>Project Preparation</td>
</tr>
<tr>
<td>04/01/2013, M</td>
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<td>Project Preparation</td>
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<tr>
<td>04/05/2013, F</td>
<td></td>
<td>Project Preparation</td>
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<td>04/08/2013, M</td>
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<tr>
<td>04/12/2013, F</td>
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<tr>
<td>04/15/2013, M</td>
<td></td>
<td>Team Presentation</td>
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<tr>
<td>04/19/2013, F</td>
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<tr>
<td>04/22/2013, M</td>
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<tr>
<td>04/26/2013, F</td>
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<tr>
<td>04/29/2013, M</td>
<td></td>
<td>Final Presentations, if needed</td>
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</tbody>
</table>

*DB – questions posed/discussed prior to class; resolved in class. Accessed via Blackboard eLearning

**SME : Subject Matter Experts, by invitation with dates subject to change
Guidelines for Team Projects & Presentations
(subject to change based on class demographics)

1. Teams of 4 students simulating an integrated asset team are to prepare a final written review paper on management practices on a field on which there is a significant amount of published information (e.g., in SPE papers) on primary performance, secondary or enhanced recovery project planning, tactical and strategic performance, surveillance, evaluation, modification, operating problems, solutions, etc. For students seeking reserves certification, these management practices should illustrate resources and reserves management specifically. The length of the paper should ordinarily be comparable to the length of a typical SPE paper. The Instructor must approve your choice of field for the project; if more than one team selects a given field, earliest notice to the Instructor gets the Team’s choice of this field. In other words, first come, first served.

2. Each team is to prepare and organize an oral presentation based on its report at a date and time posted on the course website. This presentation should ordinarily use PowerPoint slides and should be about 45-60 minutes long. The presentation will be followed by a question and answer session, typically 5-15 minutes long.

3. Grades for the report and presentation will be based on grading sheets provided on the course website.

4. One week prior to the Team’s scheduled presentation, each team will provide a pdf copy and reference information (SPE paper number or equivalent) for one selected key paper that summarizes much of the available information about the field selected for the team project. The Team’s classmates will be asked to prepare a review of the key paper, due at 8 AM on the date of presentation, following paper review guidelines posted on the course web site. Key papers required on time; this will allow the class adequate time to prepare reviews of two or more other papers by the due date for the reviews.

5. Reports are due via eLearning submission one week prior to the Team’s presentation date.

6. PowerPoint files are due via eLearning submission one week prior to the Team’s presentation date.
Americans with Disabilities Act (ADA)

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 Disability Services, in Cain Hall, Room B118, or call 979-845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity

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

For additional information please visit: http://aggiehonor.tamu.edu/Students/
Course title and number: PETE 618 – Modern Production Engineering
Term (e.g., Fall 200X): Spring 2014
Meeting times and location: Mondays, 10:20 am – 12:00 am. Rich 302.

Course Description and Prerequisites
This course is an advanced treatment of modern petroleum production engineering encompassing flow assurance; well deliverability; and diagnosis of well performance. Production and distribution of hydrocarbons from petroleum reservoirs require knowledge of flow of multiphase fluids and heat transfer between the fluids and their surroundings. The course provides basic theoretical framework for multiphase flow and heat transfer in wellbores, production logging and well performance diagnosis by downhole sensors, and artificial lift.

Learning Outcomes or Course Objectives
The goal of this course is to develop understanding and skills of modeling fluid flow and heat transfer in the various components of multiphase production systems. The course will present advanced techniques for modeling well deliverability and multiphase flow in wellbores and pipelines. Special emphasis is given to the components of multiphase production downstream of the sandface, including flow assurance, performance monitoring by downhole sensors, and problem diagnosis by production logging. Well performance improvement by artificial lift will be addressed.

Instructor Information
Name: Dr. Rashid Hasan
Telephone number: 847-8564
Email address: rashid.hasan@pe.tamu.edu
Office hours: Monday 3:00 – 5:00 pm; Tuesday 3:00 – 5:00 pm.
Office location: RICH 501E

Textbook and/or Resource Material
- Other Materials: SPE technical papers in related subjects.

Grading Policies
<table>
<thead>
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<th>Component</th>
<th>Percentage</th>
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<tr>
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<tr>
<td>Project</td>
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<tr>
<td>Final Exam</td>
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## Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1-3</td>
<td>Introduction:</td>
</tr>
<tr>
<td></td>
<td>- Overview of Single-phase flow principles, Jan 13</td>
</tr>
<tr>
<td></td>
<td>- Basic concepts, definitions, Method of analysis</td>
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<tr>
<td></td>
<td>- Homogeneous and separated flow models. Jan 20</td>
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<tr>
<td></td>
<td>- Multiphase flow models in vertical conduits Jan 27</td>
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<tr>
<td>4-5</td>
<td>Multiphase flow in Inclined systems:</td>
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<tr>
<td></td>
<td>- Flow in deviated wells. Feb 03</td>
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<td></td>
<td>- Flow in horizontal pipes. Feb 10</td>
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<tr>
<td></td>
<td>- Nonconventional systems.</td>
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<tr>
<td>6-8</td>
<td>Wellbore heat transport:</td>
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<td>- Basic Heat Transfer, Formation temperature distribution Feb 17</td>
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<tr>
<td></td>
<td>- Energy balance, fluid temperature in single conduits.</td>
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<tr>
<td></td>
<td>- Fluid temperature in gas-lift (multiple conduits). Feb 24</td>
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<tr>
<td></td>
<td>- Rate estimation from temperature.</td>
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<tr>
<td></td>
<td>- Fluid temperature during transients.</td>
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**First Midterm**

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<tr>
<td>9-12</td>
<td>Production Logging</td>
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<tr>
<td></td>
<td>- Introduction to Production Logging Mar 17</td>
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<tr>
<td></td>
<td>- Temperature Logging.</td>
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<td></td>
<td>- Tracer Logging Mar 24</td>
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<td></td>
<td>- Spinner Logging Mar 31</td>
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<td></td>
<td>- Other Loggs.</td>
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<tr>
<td>12-15</td>
<td>Artificial Lift</td>
</tr>
<tr>
<td></td>
<td>- Pump Lift: Apr 07</td>
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<td></td>
<td>- Rod Pump; Electric Submersible; Plunger Lift; Progressive Cavity Pump; Jet Pump.</td>
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<tr>
<td></td>
<td>- Gas Lift: Apr 14</td>
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<tr>
<td></td>
<td>- Well design for gas lift and gas lift valves;</td>
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<td></td>
<td>- Unloading well for initial production;</td>
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<td></td>
<td>- Gas lift design Apr 21</td>
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**Final Exam/Project**

<table>
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<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
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**Academic Integrity**

For additional information please visit: [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu)

"An Aggie does not lie, cheat, or steal, or tolerate those who do."
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. We also will perform several types of dual porosity simulations. 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>
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<tr>
<th>Lecture</th>
<th>Instructor</th>
</tr>
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<tr>
<td>TR 9:35 – 10:50 (RICH 313)</td>
<td>D.S. Schechter</td>
</tr>
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</table>

Text:

Naturally Fractured Reservoir Characterization

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:** 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: 20%
  - Simulation Workshops: 30%
  - Research Project: 30%
  - 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**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to naturally fractured reservoirs</td>
</tr>
<tr>
<td>2 - 3</td>
<td><em>Fracture Characterization:</em> Geophysical and Geological Aspects, Petrophysical and logging evaluation of naturally fractured reservoirs</td>
</tr>
<tr>
<td>4 - 5</td>
<td><em>Modelling of fractured reservoirs:</em> Defining the fracture system, static characterization of fracture system, well test analysis in fractured reservoirs</td>
</tr>
<tr>
<td>5 - 6</td>
<td><em>Reservoir Engineering:</em> Issues in reservoir engineering in naturally fractured reservoirs</td>
</tr>
<tr>
<td></td>
<td>fractured reservoirs, material balance, fracture vs. matrix porosity, relative permeability and capillary pressure, transfer mechanisms</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7 - 8</td>
<td><em>Simulation of naturally fractured reservoirs</em>: Issues in simulation, single vs. dual porosity simulation, input parameters from static model and fracture characterization, sensitivity of simulation to fracture parameters</td>
</tr>
<tr>
<td>9 - 10</td>
<td><em>Case Histories</em>: Case history of primary, secondary and enhanced oil recovery projects world-wide</td>
</tr>
<tr>
<td>11</td>
<td><em>Project Management</em>: Development of project management strategies for naturally fractured reservoirs</td>
</tr>
<tr>
<td>12</td>
<td>Final Presentations</td>
</tr>
</tbody>
</table>
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Petroleum Engineering 620 — Fluid Flow in Petroleum Reservoirs
Syllabus and Administrative Procedures
Fall 2013

Petroleum Engineering 620  Instructor: Dr. Tom Blasingame
Texas A&M University  Office: Richardson 821
College of Engineering  TL: +1.979.845.2292
TR 19:00-20:15 RICH 313 (for in-class lectures)  EM: t-blasingame@tamu.edu (Please always use e-mail to contact me)

Required Texts/Resources: (*Book must be purchased.  #Out of Print/Public Domain — Electronic file to be made available by instructor.)

Optional Texts/Resources: (+Special order at MSC Bookstore or check TAMU library.  #Local bookstores)

Course and Reference Materials:
The course materials for this course are located at:
http://www.pe.tamu.edu/blasingame/data/P620_13C/

Basis for Grade: [Grade Cutoffs (Percentages) — A: < 90  B: 89.99 to 80  C: 79.99 to 70  D: 69.99 to 60  F: < 59.99]

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<th>Task</th>
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<tr>
<td>Assigned Problems</td>
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<tr>
<td>Class Participation (subjective, based on opinion of the instructor)</td>
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</tr>
<tr>
<td>Total</td>
<td>100 percent</td>
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Policies and Procedures:
1. Students are expected to keep pace in the course.
2. Policy on Grading
   a. All work in this course is graded on the basis of answers only — any partial credit is 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.
3. Policy on Regrading
   a. Only in very rare cases will exams be considered for re-grading — partial credit (if any) is not subject to appeal.
   b. Work which, while possibly correct, but cannot be followed, will be considered incorrect.
   c. Grades assigned to homework problems will not be considered for regrading.
   d. If regrading is necessary, the student is to submit a letter to the instructor explaining the situation that requires consideration for regrading, the material to be regraded must be attached to this letter. The letter and attached material must be received within one week from the date returned by the instructor.
4. 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. If a student comes to class after homework has been turned in and after class has begun, the student's homework will be considered late and given a grade of zero. 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.
5. Each student should review the University Regulations concerning attendance, grades, and scholastic dishonesty. In particular, anyone caught cheating on an examination or collaborating on an assignment where collaboration is not specifically authorized by the instructor will be removed from the class roster and given an F (failure grade) in the course.

Course Description
Graduate Catalog: Analysis of fluid flow in bounded and unbounded reservoirs, wellbore storage, phase redistribution, finite and infinite conductivity vertical fractures, dual-porosity systems.
Translation: Development of skills required to derive "classic" problems in reservoir engineering and well testing from the fundamental principles of mathematics and physics. Emphasis is placed on a mastery of fundamental calculus, analytical and numerical solutions of 1st and 2nd order ordinary and partial differential equations, as well as extensions to non-linear partial differential equations that arise for the flow of fluids in porous media.
Course Outline/Topics:

Advanced Mathematics Relevant to Problems in Engineering: (used throughout assignments)
- Approximation of Functions
  - Taylor Series Expansions and Chebyshev Economizations
  - Numerical Differentiation and Integration of Analytic Functions and Applications
  - Least Squares
- First-Order Ordinary Differential Equations
- Second-Order Ordinary Differential Equations
- The Laplace Transform
  - Fundamentals of the Laplace Transform
  - Properties of the Laplace Transform
  - Applications of the Laplace Transform to Solve Linear Ordinary Differential Equations
  - Numerical Laplace Transform and Inversion
- Special Functions

Petrophysical Properties:
- Porosity and Permeability Concepts
- Correlation of Petrophysical Data
- Concept of Permeability — Darcy's Law
- Capillary Pressure
- Relative Permeability
- Electrical Properties of Reservoir Rocks

Fundamentals of Flow in Porous Media:
- Steady-State Flow Concepts: Laminar Flow
- Steady-State Flow Concepts: Non-Laminar Flow
- Material Balance Concepts
- Pseudosteady-State Flow in a Circular Reservoir
- Development of the Diffusivity Equation for Liquid Flow
- Development of the Diffusivity Equations for Gas Flow
- Development of the Diffusivity Equation for Multiphase Flow

Classical Reservoir Flow Solutions:
- Dimensionless Variables and the Dimensionless Radial Flow Diffusivity Equation
- Solutions of the Radial Flow Diffusivity Equation — Infinite-Acting Reservoir Case
- Laplace Transform (Radial Flow) Solutions — Bounded Circular Reservoir Cases
- Real Domain (Radial Flow) Solutions — Bounded Circular Reservoir Cases
- Linear Flow Solutions: Infinite and Finite-Acting Reservoir Cases
- Solutions for a Fractured Well — High Fracture Conductivity Cases
- Dual Porosity Reservoirs — Pseudosteady-State Interporosity Flow Behavior
- Direct Solution of the Gas Diffusivity Equation Using Laplace Transform Methods
- Convolution and Concepts and Applications in Wellbore Storage Distortion

Advanced Reservoir Flow Solutions: (Possible Coverage)
- Multilayered Reservoir Solutions
- Dual Permeability Reservoir Solutions
- Horizontal Well Solutions
- Radial Composite Reservoir Solutions
- Models for Flow Impediment (Skin Factor)

Applications/Extensions of Reservoir Flow Solutions: (Possible Coverage)
- Oil and Gas Well Flow Solutions for Analysis, Interpretation, and Prediction of Well Performance
- Low Permeability/Heterogeneous Reservoir Behavior
- Macro-Level Thermodynamics (coupling PVT behavior with Reservoir Flow Solutions)
- External Drive Mechanisms (Water Influx/Water Drive, Well Interference, etc.).
- Hydraulic Fracturing/Solutions for Fractured Well Behavior
- Analytical/Numerical Solutions of Various Reservoir Flow Problems.
- Applied Reservoir Engineering Solutions — Material Balance, Flow Solutions, etc.
## Tentative Course Schedule

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Day</th>
<th>Method</th>
<th>Topic</th>
<th>Lecture or Potential Topic</th>
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<tr>
<td>Aug</td>
<td>27</td>
<td>T</td>
<td>Class</td>
<td>Review of Functions</td>
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<td>29</td>
<td>R</td>
<td>Class</td>
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<tr>
<td>Sep</td>
<td>03</td>
<td>T</td>
<td>Class</td>
<td>1st Order Ordinary Differential Equations</td>
<td>Lec_03_Mod1_ML_03_1st_Order_ode.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>05</td>
<td>R</td>
<td>Video/Travel</td>
<td>2nd Order Ordinary Differential Equations</td>
<td>Lec_04_Mod1_ML_04_2nd_Order_ode.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>10</td>
<td>T</td>
<td>Video/SPE</td>
<td>The Laplace Transform</td>
<td>Lec_05_Mod1_ML_05_LaplaceTrans.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>12</td>
<td>R</td>
<td>Video/SPE</td>
<td>Introduction to Special Functions</td>
<td>Lec_06_Mod1_ML_06_SpecialFcns.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>17</td>
<td>T</td>
<td>Video/Travel</td>
<td>Porosity and Permeability Concepts</td>
<td>Lec_07_Mod2_PtrPhy_01_PorPerm.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>19</td>
<td>R</td>
<td>Video/Travel</td>
<td>Correlation of Petrophysical Data</td>
<td>Lec_08_Mod2_PtrPhy_02_DataCorel.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>24</td>
<td>T</td>
<td>Video/NZ</td>
<td>Development of Poromeic's Law</td>
<td>Lec_09_Mod2_PtrPhy_03_Perm_Dev.pdf</td>
</tr>
<tr>
<td>Sep</td>
<td>25</td>
<td>W</td>
<td>—</td>
<td>Assignment 1 Due</td>
<td>Math and/or Petrophysics</td>
</tr>
<tr>
<td>Sep</td>
<td>26</td>
<td>R</td>
<td>Video/SPE</td>
<td>Capillary Pressure</td>
<td>Lec_10_Mod2_PtrPhy_04_Cap_Pres.pdf</td>
</tr>
<tr>
<td>Oct</td>
<td>01</td>
<td>T</td>
<td>Video/SPE</td>
<td>Relative Permeability</td>
<td>Lec_11_Mod2_PtrPhy_05_Rel Perm.pdf</td>
</tr>
<tr>
<td>Oct</td>
<td>03</td>
<td>R</td>
<td>Video/SPE</td>
<td>Electrical Properties of Reservoir Rocks</td>
<td>Lec_12_Mod2_PtrPhy_06_Elec_Prop.pdf</td>
</tr>
<tr>
<td>Oct</td>
<td>08</td>
<td>T</td>
<td>Video/Travel</td>
<td>Single-Phase, Steady-State Flow</td>
<td>Lec_13_Mod3_FunFld_01_SSDarcy.pdf</td>
</tr>
<tr>
<td>Oct</td>
<td>10</td>
<td>R</td>
<td>Video/Travel</td>
<td>Non-Laminar Flow in Porous Media</td>
<td>Lec_14_Mod3_FunFld_02_SNonDarcy.pdf</td>
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<tr>
<td>Oct</td>
<td>15</td>
<td>T</td>
<td>Video/SPE</td>
<td>Material Balance Concepts</td>
<td>Lec_15_Mod3_FunFld_03_MatBal.pdf</td>
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<tr>
<td>Oct</td>
<td>17</td>
<td>R</td>
<td>Video/SPE</td>
<td>Pseudosteady-State Flow (Circular Res.)</td>
<td>Lec_16_Mod3_FunFld_04_PSS_Flow.pdf</td>
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<tr>
<td>Oct</td>
<td>22</td>
<td>T</td>
<td>Video/NZ</td>
<td>Liquid Flow Diffusivity Equation</td>
<td>Lec_17_Mod3_FunFld_05_DiffEq_Liq.pdf</td>
</tr>
<tr>
<td>Oct</td>
<td>29</td>
<td>T</td>
<td>Video/Travel</td>
<td>Multiphase Flow Diffusivity Equation</td>
<td>Lec_19_Mod3_FunFld_07_DiffEq_MPlhs.pdf</td>
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<tr>
<td>Oct</td>
<td>30</td>
<td>W</td>
<td>—</td>
<td>Assignment 2 Due</td>
<td>Pseudosteady-State and/or Diffusivity Equations</td>
</tr>
<tr>
<td>Oct</td>
<td>31</td>
<td>R</td>
<td>Class</td>
<td>Dimensionless Variables/Radial Flow</td>
<td>Lec_20_Mod4_ResFlw_01_DimLssVar.pdf</td>
</tr>
<tr>
<td>Nov</td>
<td>05</td>
<td>T</td>
<td>Video/Travel</td>
<td>Solutions — Radial Flow Diffusivity Eq.</td>
<td>Lec_21_Mod4_ResFlw_02_radial_flw_sl.pdf</td>
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<tr>
<td>Nov</td>
<td>07</td>
<td>R</td>
<td>Video/Travel</td>
<td>Solutions — Radial Flow Diffusivity Eq.</td>
<td>Lec_21_Mod4_ResFlw_02_RADIAL_FLOW.png</td>
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<tr>
<td>Nov</td>
<td>12</td>
<td>T</td>
<td>Video/SPE</td>
<td>Solutions — Linear Flow Diffusivity Eq.</td>
<td>Lec_22_Mod4_ResFlw_03_LinFlwSl.pdf</td>
</tr>
<tr>
<td>Nov</td>
<td>14</td>
<td>R</td>
<td>Video/SPE</td>
<td>Solutions — Fractured Well (High F_r)</td>
<td>Lec_23_Mod4_ResFlw_04_FracWellSl.pdf</td>
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<tr>
<td>Nov</td>
<td>19</td>
<td>T</td>
<td>Video/NZ</td>
<td>Solutions — Dual Porosity Reservoirs</td>
<td>Lec_24_Mod4_ResFlw_05_NatFrcResSl.pdf</td>
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<tr>
<td>Nov</td>
<td>21</td>
<td>R</td>
<td>Video/NZ</td>
<td>Direct Solution — Gas Diffusivity Equation</td>
<td>Lec_25_Mod4_ResFlw_06_OrgINGas.pdf</td>
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<tr>
<td>Nov</td>
<td>26</td>
<td>T</td>
<td>Video/NZ</td>
<td>Convolution</td>
<td>Lec_26_Mod4_ResFlw_07_Convolution.pdf</td>
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<tr>
<td>Nov</td>
<td>27</td>
<td>W</td>
<td>—</td>
<td>Assignment 3 Due</td>
<td>Radial Flow, Fractured Wells and/or Dual Porosity</td>
</tr>
<tr>
<td>Nov</td>
<td>28</td>
<td>R</td>
<td>—</td>
<td>Thanksgiving Holiday (no class)</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td>03</td>
<td>T</td>
<td>Class</td>
<td>Wellbore Storage</td>
<td>Lec_27_Mod4_ResFlw_08_WellboreStrg.pdf</td>
</tr>
<tr>
<td>Dec</td>
<td>04</td>
<td>W</td>
<td>—</td>
<td>Assignment 4 Due</td>
<td>Individual Projects</td>
</tr>
<tr>
<td>Dec</td>
<td>05</td>
<td>R</td>
<td>Reading Day</td>
<td>No class</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td>11</td>
<td>W</td>
<td>—</td>
<td>Any/all remaining assignments due.</td>
<td>(<a href="http://registrar.tamu.edu/general/finalsched">http://registrar.tamu.edu/general/finalsched</a> ule.aspx#_Fall_2013)</td>
</tr>
<tr>
<td>Dec</td>
<td>12</td>
<td>R</td>
<td>—</td>
<td>Final grades due GRADUATING students.</td>
<td>(<a href="http://registrar.tamu.edu/general/calendar.aspx">http://registrar.tamu.edu/general/calendar.aspx</a>)</td>
</tr>
<tr>
<td>Dec</td>
<td>16</td>
<td>M</td>
<td>—</td>
<td>Final grades for all students Fall 2013 term.</td>
<td>(<a href="http://registrar.tamu.edu/general/calendar.aspx">http://registrar.tamu.edu/general/calendar.aspx</a>)</td>
</tr>
</tbody>
</table>

### Notes:
1. Class = Lecture in classroom (RIC 313)
2. Video/NZ = Lecture video from home in New Zealand (should be easily available by e-mail (t-blasingame@tamu.edu)).
3. Video/SPE = Lecture video during 3 SPE conferences (likely to have limited e-mail availability during those days).
4. Video/Travel = Lecture video during travel days (limited or no e-mail availability during those specific days).

### Comments:
0. My travel is horrible — I know. There are 4 extra sets of meetings that I agreed to in isolation (i.e., I can never say no…).
1. Known Full Days in College Station: 26-31 Aug; 01-04 Sep; 03-04,30-31 Oct; 01-04 Nov; 03-31 Dec.
2. We will meet in "extra session" when I am physically in College Station (in Oct/Nov/Dec)
3. *This course is NOT self-study, we will interact regularly via video/e-mail/telegraph/smoke signals/etc.*
Americans with Disabilities Act (ADA) 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 Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall, or call 845-1637.

Aggie Honor Code: (http://www.tamu.edu/aggiehonor/)

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

Definitions of Academic Misconduct:

1. CHEATING: Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices or materials in any academic exercise.
2. FABRICATION: Making up data or results, and recording or reporting them; submitting fabricated documents.
3. FALSIFICATION: Manipulating research materials, equipment or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
4. MULTIPLE SUBMISSION: Submitting substantial portions of the same work (including oral reports) for credit more than once without authorization from the instructor of the class for which the student submits the work.
5. PLAGIARISM: The appropriation of another person's ideas, processes, results, or words without giving appropriate credit.
6. COMPLICITY: Intentionally or knowingly helping, or attempting to help, another to commit an act of academic dishonesty.
7. ABUSE AND MISUSE OF ACCESS AND UNAUTHORIZED ACCESS: Students may not abuse or misuse computer access or gain unauthorized access to information in any academic exercise. See Student Rule 22: http://student-rules.tamu.edu/
8. VIOLATION OF DEPARTMENTAL OR COLLEGE RULES: Students may not violate any announced departmental or college rule relating to academic matters.
9. UNIVERSITY RULES ON RESEARCH: Students involved in conducting research and/or scholarly activities at Texas A&M University must also adhere to standards set forth in the University Rules.

For additional information please see:
http://student-rules.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, 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, writings, 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."
Petroleum Engineering 621
Petroleum Development Strategy
Syllabus and Schedule for Fall 2013

Course Description: Applications of the variables, models and decision criteria used in modern petroleum development; case approach used to study major projects such as offshore development and assisted recovery. (From Texas A&M University Graduate Catalog, 2012-2013)

Instructor: Priscilla G. McLeroy, P.E., Professor of Engineering Practice
979.845.2907
priscilla.mcleroy@pe.tamu.edu
Office - 916G Richardson Building
Office Hours - By appointment or if my office door is open

Reference Texts:
Mian, M. A., Project Economics and Decision Analysis, Volumes I & II: Deterministic & Probabilistic Models 2nd Edition, PennWell (Tulsa) 2011. We will reference the books in some of the lectures, but the course lectures will not be directly from the books. Necessary reference materials will be posted on eCampus system.

Course Learning Objectives:
1. Experience how strategies are formulated from diverse petroleum development perspectives.
2. Experience how to simulate petroleum portfolios from mindset of public companies, private equity company, and state-controlled resources.
3. Understand how to apply fit-for-purpose decision tools relative to strategic objective.
4. Understand trade-offs between growth, develop, and harvest strategies and how to leverage all within a petroleum portfolio.

Class Schedule: Tuesday and Thursday, 12:45 p.m. to 2:00 p.m.

Course Requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams</td>
<td>30%</td>
</tr>
<tr>
<td>Homework and classroom participation</td>
<td>30%</td>
</tr>
<tr>
<td>Team Project &amp; Professionalism</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Typically homework is assigned every week with results submitted via eCampus prior to class discussion. Homework discussions will be led in class for Resident students by random selection. DL students will contribute to Homework discussion online.

There will be 2 in-class exams. Each DL student will need to return the completed exam by 5 pm on the following Monday according to instructions provided with the exam.

Each team will do a final project. The project will be assigned at the time of the first exam. Each team will present the project during the week following the last lecture class. The final project report is due the week after the project presentations. Professionalism will be evaluated based on class attendance, quality of contributions (online and Resident).

PETE 621 Syllabus and Schedule - Fall 2013
Additional Notes:
1. Course material and assignments will be posted on eCampus throughout the course to accommodate updates as we progress through the course; therefore, monitoring the site daily is required.
2. Homework is due before class begins on the due date, and should be submitted electronically via eCampus unless specified otherwise. Homework will be graded 100% for a good effort, 50% for a poor effort and zero for no effort. Late homework will receive a grade of zero.
3. As part of homework assignments, you will be responsible for preparing reviews of all papers assigned for discussion in class and for all guest lectures. Please follow paper review guidelines, to be provided separately to you.
4. Examinations will be open book and you will have up to four hours to complete over eCampus within a 72 hour period. Exceptions should be brought to the Instructor’s attention a week in advance.

Topics Covered:
1. “Life Cycle” Project Economics
2. Petroleum Resource Management System, Reserves Assessment
3. Fiscal Regimes and Strategies
4. Company Drivers and Strategies
5. Capital Management Strategies
6. Portfolio Management Strategies – Tangible & Intangible (Technology)
7. Strategic Decision Processing
8. Acquisition and Development Strategies – Valuation Implications
9. Oil & Gas Law and Influence on Strategies

eCampus Account:
Course information including assignments, announcements, etc. will be posted regularly to the PETE621 eCampus website. To set up your account for this course, please contact ITSHelp.tamu.edu. Secondary resources within the Department of Petroleum Engineering are Mary Lu Epps and Ted Seidel, 4th Floor, Richardson Building.

Before classes start your first assignment posted on eCampus will ask you to submit a brief description of your experience in the energy industry, who you work for, and contact information for the benefit of outside discussion between resident and DL students. Also you will be asked to submit a picture of yourself to Mary Lu so we can all associate a face with a name.

Academic Integrity Statement:
"An Aggie does not lie, cheat, or steal or tolerate those who do."

All students refer to the Honor Council Rules and Procedures on the web http://www.tamu.edu/aggiehonor < http://www.tamu.edu/aggiehonor>

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PETE 621 Syllabus and Schedule - Fall 2013
### PETE 621 - Petroleum Development Strategy - Fall 2013 Schedule

**Instructor:** Priscilla G. McLeroy, P.E.  
priscilla.mcleroy@pe.tamu.edu  
**Prerequisites:** basic petroleum project economics  
**Meets:** 12:45p – 2:00p Tuesday & Thursday  
**Resources:** posted lecture notes and reference materials

**Synopsis** - This course covers selected strategies and analysis tools used in petroleum development programs from the diverse perspectives of public companies, private equity company, and state-controlled resources. Students will review papers on the petroleum resource management system, pricing, acquisitions, risk and uncertainty, public company growth strategies, and portfolio management. Some lectures may be topics from industry guests.

<table>
<thead>
<tr>
<th>Lecture Series</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Life Cycle&quot; Upstream Project Building Blocks</td>
<td>(a) course introduction - syllabus, schedule, requirements; (b) life cycle economics - exploration to abandonment; (c) Petroleum Resource Management System &amp; reserves determination; (d) deterministic cash flow models – assumptions; (e) commercial analysis, CAPEX, OPEX, AFIT; (f) stochastic models - distributions of uncertainty; (g) stochastic cash flow conceptual modeling</td>
</tr>
<tr>
<td>Decline Curve Analyses</td>
<td>Conventional and Unconventional - review technical principles and comparisons</td>
</tr>
<tr>
<td>Capital at Work</td>
<td>Strategies for managing capital - cash flow, major projects, and debt</td>
</tr>
<tr>
<td>Fiscal Regimes – Upstream E&amp;P</td>
<td>(a) Drivers - State interests, NOC interests, IOC interests; (b) compensation structures; (c) fiscal systems of host countries</td>
</tr>
<tr>
<td>Company Strategies</td>
<td>(a) Overview of drivers and forces influencing strategic planning; (b) Public company growth, development, harvest strategies; (c) Private Equity company relative drivers and business plan structures; (d) NOC relative drivers</td>
</tr>
<tr>
<td>E&amp;P Portfolio Strategy</td>
<td>Portfolio management strategy – theory, stochastic budgeting, portfolio simulation under risk and uncertainty</td>
</tr>
<tr>
<td>E&amp;P Asset Strategies</td>
<td>Greenfield, brownfield, unconventional, onshore, offshore E&amp;P assets – unique strategic considerations</td>
</tr>
<tr>
<td>Oil &amp; Gas Land and Legal Strategic Considerations</td>
<td>Strategies to structure, operate and exit E&amp;P assets – pooling/communitization, risk-based business structures, divestiture, bankruptcy</td>
</tr>
<tr>
<td>Acquisition, Development and Divestment Strategies</td>
<td>Overview of asset acquisition, development, and divestment process; evaluation and screening examples; due diligence traps and strategies to complete the deal</td>
</tr>
</tbody>
</table>

**Team Projects** – Target company/NOC evaluation of current Upstream strategies, performance, relative portfolio and Team’s recommended future strategies
Petroleum Engineering 622 Exploration and Production Evaluation  
Syllabus and Administrative Procedures  
Fall 2014

Instructor: Priscilla G. McLeroy, P.E.  
Contact Information: 979-845-2907; 
Email: priscilla.mcleroy@pe.tamu.edu  
Office: Room 916G Richardson Building  
Office Hours: Generally open on Monday/Thursday/Friday

Text: None required  
References:  


We will reference the books in some of the lectures, but the course lectures will not be directly from the books. Other selected publications for reference materials will be posted on eCampus system.

Course Catalog Description:  Exploration and Production Evaluation. (2-3). Credit 3. Selected topics in oil industry economic evaluation including offshore bidding, project ranking and selection, capital budgeting, long-term oil and gas field development projects and incremental analysis for assisted recovery and acceleration.

Topics Covered: The focus will be on conceptual understanding, practical application and comprehending the strength and weaknesses of the various project models and management processes. The material learned in this course underlies the economic evaluation of projects large and small – from the economics of a fracture stimulation, through side-tracking a well, to major field development decisions. The importance of the distinction between new and incremental projects will be made. Students will leave with the ability to carry out straightforward economic calculations that do not involve complex tax regimes. Finally, the impacts of uncertainty in the data that goes into economic calculations, and how risk is dealt with, will be discussed. After the course, the students will understand:

- Context and purpose of economic evaluation
- Developing Net Cash Flow (NCF) estimates
- Revenue and Expense (Capital and Operating) streams
- Depletion, Depreciation and Abandonment provisions
- Taxes, Royalties and Production Sharing Contracts
- Discounted Cash Flow analysis: time value of money and discount rates
- Value and investment metrics: Net Present Value, Rate-of-Return, Return-on-Investment, Investment Efficiency, hurdle rates
- Incremental vs acceleration projects
- Strengths and weaknesses of DCF and NPV
- Sources of uncertainty and accounting for risk
- Principles of risk reduction through diversification in oil & gas investments – not just that they work, but why they work
• Developing a systematic approach to project development
• Understanding how project development ties directly to the corporate business strategy
• Use of Monte Carlo simulation and other tools such as stochastic optimization in the context of a portfolio of projects developed
• Implementing the optimized portfolio using fundamental project management principles

Class Schedule: Mondays and Fridays, 9:10a – 10:30a

Course Requirements:

| Homework and class participation       | 60% |
| Team Project & Professionalism        | 40% |
| Total                                 | 100%|

Typically homework is assigned every week with results submitted via eCampus prior to class discussion. Homework discussions will be led in class for Resident students by random selection. DL students will contribute to Homework discussion online.

Each team will do a final project which will be presented the final scheduled class(es) period(s) depending on number of teams. The final project report is due the week after the project presentations. Professionalism will be evaluated based on class attendance, quality of contributions (online and Resident).

Additional Notes:
1. Course material and assignments will be posted on eCampus throughout the course to accommodate updates as we progress through the course; therefore, monitoring the site daily is required.
2. Homework is due before class begins on the due date, and should be submitted electronically via eCampus unless specified otherwise. Homework will be graded 100% for a good effort 50% for a poor effort and zero for no effort. Late homework will receive a grade of zero.
3. As part of homework assignments, you will be responsible for preparing reviews of all papers assigned for discussion in class and for all guest lectures. Please follow paper review guidelines, to be provided separately to you.

Notes:
1. Homework is due at the start of class. Late homework will receive the grade zero.
2. Class discussions will include reading assignments and homework. Please come to class prepared to discuss the assigned topics for the day.
3. Assignments and other course materials will be posted on eCampus. You will need to establish an eCampus account for this class and monitor the web site regularly.

eCampus Account

Because course information will be posted on eCampus regularly, I ask that you please monitor at least once a day. If you need help setting up your eCampus account, please contact Mary Lu Épps or Ted Seidel in the 407 office suite.
Academic Integrity Syllabus
Statement

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

All syllabi shall contain a section that states the Aggie Honor Code and refers the student to the Honor Council Rules and Procedures on the web
http://www.tamu.edu/aggiehonor < http://www.tamu.edu/aggiehonor>

It is further recommended that instructors print the following on assignments and examinations:

"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."

______________________________________________________________________________

Signature of student

Americans with Disabilities Act (ADA) Policy Statement

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Petroleum Engineering 623  
Waterflooding  
Syllabus and Administrative Procedures  
Fall 2006

Instructor: Daulat Mamora  
Contact Information: Phone 979-845-2962, 845-4071 (lab, R508)  
Email: daulat.mamora@pe.tamu.edu  
Office: R709, Richardson Building  
Office Hours: Wednesdays & Fridays, 4:00 – 5:00 p.m.

Textbooks and Reading Material:  
Selected papers from SPEJ, JPT, JCPT, etc.

Class Schedule: Tuesdays and Thursdays, 9:35 – 10:50 hrs, R302

Course Policies:  
1. Attendance: Class attendance is important. A seating chart will be established. If an illness or an unexpected event prevents attendance, the student should notify the instructor before class. Students should read reference material in advance and be prepared for class discussions.

2. Assignments: Homework is due at the beginning of the following lecture unless otherwise stated. Late homework may not be accepted. Assignments and other course materials will be posted on (WebCT) Vista. You will need to establish a (WebCT) Vista account for this class and monitor the web site regularly.

3. Work Quality: Neat, legible, systematic and complete presentation is required in assignments, quizzes and examinations for full credit. Units must be written wherever appropriate for the answers.

4. Examinations: Examinations are not optional. Unless otherwise announced, the format will be closed book and closed notes. Make-up or major examinations will be given only for university excused absences.

5. Grading System: The regular university grading scale will be used. Weights will be assigned as follows:  
a. Homework ............................................................................. 30%  
b. Midterm Exam....................................................................... 35%  
c. Final Examination ................................................................... 35%

6. 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 other penalties as outlined in the Texas A&M University Student Rules.
Because course information will be posted on Vista regularly, I ask that you please monitor at least once a day. To set up your Vista account for this course, please do the following:

Go to elearning.tamu.edu.
Find the link to TAMU login. Click the link.
Use your NetID (Neo ID and password) to logon.
Click on the course name.

This should be all you need. If you think you can't get there from here, please contact Mary Lu Epps (marylu.epps@pe.tamu.edu) or Ted Jones (ted.jones@pe.tamu.edu) in the 407 office suite for help.

**Academic Integrity Syllabus Statement**

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

All syllabi shall contain a section that states the Aggie Honor Code and refers the student to the Honor Council Rules and Procedures on the web [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor)

**Americans with Disabilities Act (ADA) Policy Statement**

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the UCC by the Department of Student Life. The policy statement was forwarded to the Faculty Senate for information.

The Americans with Disabilities Act (ADA) is a federal antidiscrimination 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 that you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building, or call 845-1637.

*Formerly known as WebCTVista ([http://elearning.tamu.edu](http://elearning.tamu.edu))
Texas A&M University  
Department of Petroleum Engineering  
Rock Mechanics of Reservoirs (PETE 624)  
Fall 2009

Description: Reservoir rocks and their response to imposed loads encountered in reservoir development. Influence of stress, fluid pressure, temperature, and chemistry on rock properties and deformation in the context of wellbore stability, fracture propagation, fracture flow, and reservoir mechanics (3 Cr). Prerequisite: Consent of the Instructor.

Instructor: TBD

Course Objectives:

- To learn the fundamental principles of rock mechanics to quantify rock deformation/fracture and fluid flow in response to variations in stress, pore pressure, temperature.

- To learn to apply rock mechanics to prediction of fracture gradient, hydraulic fracturing, borehole stability, and reservoir mechanics.


Grading:

- Homework (25%)
- Two Exams (50%)
- Project/Presentations (25%)
COURSE CONTENT

1. INTRODUCTION
   - Course objectives
   - Overview of petroleum rock mechanics
   - Inherent complexities in rock mechanics

2. ROCK MATERIAL
   - Reservoir rock properties; scale dependence and size effect
   - Rock mass structure, discontinuities and their properties
   - Collection and presentation of structural data; rock mass classification

3. ANALYSIS OF STRESS, STRAIN, AND STRENGTH
   - Stress and strain tensors
   - Rock deformation, strength & failure criterion
   - Mohr-Coulomb failure criterion
   - Effects of pore fluid, temperature, fractures
   - Size and scale effects
   - Determination of rock strength; static & dynamic laboratory tests

4. LABORATORY TESTING OF ROCKS
   - Point Load/Brazilian test
   - Uniaxial compression
   - Triaxial tests
   - Shear box test/others

5. LINEAR ELASTICITY & METHODS OF STRESS ANALYSIS
   - Generalized Hooke's law
   - Analysis of laboratory triaxial compression test
   - Principles of classical stress analysis
   - Closed-form solutions

6. IN-SITU STRESS
   - In-situ stress regimes; estimating the stress state
   - Hydraulic fracturing; flat jack; overcoring
   - Drilling induced cracks; wellbore breakouts

7. ELEMENTS OF THERMOELASTICITY & POROELASTICITY

8. APPLICATIONS IN PETROLEUM RESERVOIR DEVELOPMENT
   - wellbore stability
   - Rock fracture & fluid flow
   - Reservoir mechanics
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**Academic Integrity Statement and Policy:** For many years Aggies have followed a Code of Honor, which is stated in this very simple verse: “An Aggie does not lie, cheat, or steal or tolerate those who do.”

The Aggie Code of Honor is an effort to unify the aims of all Texas A&M men and women toward a high code of ethics and personal dignity. For most, living under this code will be no problem, as it asks nothing of a person that is beyond reason. It only calls for honesty and integrity, characteristics that Aggies have always exemplified. The Aggie Code of Honor functions as a symbol to all Aggies, promoting understanding and loyalty to truth and confidence in each other. For additional information visit:

http://www.tamu.edu/aggiehonor
PETE 625 – Well Control

Catalog Data: PETE 625. Well Control. (3.0). Credit 3. Theory of pressure control in drilling operations and during well kicks; abnormal pressure detection and fracture gradient determination; casing setting depth selection and advanced casing design; theory supplemented on well control simulators. Prerequisite: PETE 661


3. Class notes can be found at S drive or ecampus

Course Grade: Homework 20%
Project 20%
Quiz A 20%
Quiz B 20%
Quiz C 20%

Instructor: Dr. Jerome J. Schubert, PE

Office: 501 K Richardson

Phone: 979/862-1195

e-mail: jschubert@tamu.edu

Office Hours: TR 9:00 – 11:00 am (or by appointment)
Topics:

Topic 1. Introduction to course
   Basic Concepts
   Read: Schubert, Chap. 1-2
        Watson, Chap. 1-2

Topic 2. Gas Behavior and Fluid Hydrostatics
   Read: Schubert, Chap. 1-2
        Watson, Chap. 1-2

Topic 3. Pore Pressure Prediction
   Read: Schubert, Chap. 9
        Watson, Chap. 3

Topic 4. Formation Fracture Gradients
   Read: Schubert, Chap. 9
        Watson, Chap. 4

Topic 5. Kick Detection and Control Methods
   Read: Schubert, Chap. 3-6
        Watson, Chap. 5

Topic 6. Secondary Well Control Complications
   Read: Schubert, Chap. 6, 13
        Watson, Chap. 6

Topic 7. Special Well Control Applications
   Read: Schubert, Chap. 13
        Watson, Chap. 7

Topic 8. Well Control Equipment
   Read: Watson, Chap. 8

Topic 9. Offshore and Subsea Well Control
   Read: Schubert, Chap. 15
        Watson, Chap. 9

Topic 10. Blowout Control
   Read: Watson, Chap. 10

Topic 11. Snubbing and Stripping
   Read: Schubert, Chap. 13
        Adams, Chap. 6
        Watson, Chap. 11
Topic 12. Casing Seat Selection
Read: Schubert, Chap. 9
Watson, Chap. 12

Topic 13. SMD Well Control

Topic 14. Well Workover/Well Completion Well Control
Read: Watson, Chap. 7
Adams
Petroleum Engineering 626
Offshore Drilling
Syllabus and Administration Procedures
Spring 2013

Instructor: Jerome Schubert
Office: Room 501-K, Richardson Building
Office Hours: M and W; 10:00 – 11:00 a.m.
Office Phone: 979-862-1195, (E-Mail) jerome.schubert@pe.tamu.edu

Catalogue Description:
Offshore drilling from fixed and floating drilling structures; deepwater drilling; Dual Gradient Drilling; Shallow hazards.

Pre-requisites: 405 or 661


Selected Papers.

Class Schedule:
Lecture: MWF – 1:50 p.m. – 2:40 p.m., Room 208 RICH

Basis for grade:
Homework ................................................................. 20%
Exam 1 ........................................................................ 20%
Exam 2 ........................................................................ 20%
Project ......................................................................... 20%
Final Exam ................................................................. 20%
100%

Grading Policy:
>89.5 =A
79.5 – 89.4999 =B
69.5 – 79.4555 =C
59.5 – 69.4999 =D
<59.5 =F

Topics:
Drilling a well from a floating vessel; station keeping 6 HRS
Wellheads; casing program; blowout preventers 4 HRS
The drilling riser; riser tensioning; drilling hydraulics 5 HRS
Motion compensation; formation testing; shallow water flows 5 HRS
Special problems in floating drilling 3 HRS
Drilling Hydraulics 3 HRS
Formation Testing 3 HRS
Shallow water flows, hydrates, and potential problems 2 HRS
Deepwater Drilling 2 HRS
Dual Gradient Drilling 9 HRS
Deep water development schemes 3 HRS

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http://www.tamu.edu/aggiehonor
Course title and number          PETE 627 - Well Completion and Workover
Term (e.g., Fall 200X)           Fall 2010
Meeting times and location      N/A; distance learning group only

Course Description and Prerequisites
This course provides an overview of completions and workover equipment and methods in the oil and gas industry. It is designed to complement the courses on drilling and production engineering which are already offered by the department. The students will learn about the design options to meet deliverability, safety and integrity requirements in completions and workover operations. The main components of a well are described and analyzed by their function and design criteria. The workover systems and procedures are presented and discussed. Case studies will be provided and a group project will help the students understand the hands-on aspects of completions and workovers.
Prerequisite: Graduate classification.

Learning Outcomes or Course Objectives
The objectives of the course are for students to:
1. Gain an overall understanding of completions and workover equipment and methods in the oil and gas industry.
2. Learn about design options available for completions and workover operations.
3. Understand the main components, function and design criteria of a well, and workover systems and procedures.
4. Understand the hands-on aspects of completions and workovers via case studies and a group project.

Instructor Information
Name                                Dr. Catalin Teodoriu
Telephone number                    (979) 845-6164
Email address                      catalin.teodoriu@pe.tamu.edu
Office hours                       501J Richardson Building

Textbook and/or Resource Material
D. Perrin, Well Completion and Servicing, Edition Technip, 1999
References                        
Selected papers                   

Grading Policies
Final Exam.................................................................(60%)
Group Projects/Homework......................(40%)
Total.................................................................(100%)

Grading Scale
A................................................................. 90-100%
B................................................................. 80-89%
C................................................................. 70-79%
D................................................................. 60-69%
F................................................................. 0-59%
### Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Well completion: types of wells, completion functions, types of completion</td>
</tr>
<tr>
<td>2</td>
<td>Mechanical aspects of well testing, cased hole logging equipment and application, and perforation methods and perforating equipment</td>
</tr>
<tr>
<td>3</td>
<td>Packers: function, application, proper selection; includes water/gas shot off, horizon separation, etc.</td>
</tr>
<tr>
<td>4</td>
<td>Completion equipment (SSD, SSSV, mandrels, locks, etc.)</td>
</tr>
<tr>
<td>5</td>
<td>Data acquisition in wells; Fibre optics, permanent gauges, memory gauges, SCADA systems; Intelligent completion equipment</td>
</tr>
<tr>
<td>6-7</td>
<td>Tubing string design (dimension, materials, connections,...) based on pressure, temp. operating conditions, media, safety requirements</td>
</tr>
<tr>
<td>8-9</td>
<td>HPHT and horizontal well completions; Workover equipment: WireLine, Snubbing Unit, Coil Tubing</td>
</tr>
<tr>
<td>10</td>
<td>Completion and Workover design and execution</td>
</tr>
<tr>
<td>11</td>
<td>Special Topic: industry people are invited to give presentations on specific topics</td>
</tr>
<tr>
<td>12-14</td>
<td>Class Project</td>
</tr>
</tbody>
</table>

### Other Pertinent Course Information

Some classes will be delivered in collaboration with:

[Collaboration Information]

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### Academic Integrity

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“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Course title and number  PE 628 – Horizontal Drilling  
Term  Fall 2010  
Meeting times and location  T-Th 12:45-2:00 Richardson 313  

Course Description  
This course will review and investigate critical technologies for directional, horizontal, and extended reach drilling. The course will focus on designing 3 or 4 actual wells, and will follow the daily progress of drilling these wells. Students will be expected to independently investigate specific topics (listed below), preparing and presenting a summary presentation to the class. Class will be informal with participation expected.

Instructor Information  
Name  
Telephone number  
Email address  
Office hours  T-Th 11:00a.m.-12:30 p.m. or by appointment  
Office location  

Textbook and/or Resource Material  
Class handouts and SPE papers will provide the core material; Applied Drilling Engineering (Bourgoyne et. al) is a good reference.

Grading Policies  
Grades will be based on:  
Midterm Exam – 40%  
Presentation – 20%  
Final Exam – 40%  

Topics  
Well Planing (2D & 3D), Well Positioning, Error Models and Anti-Collision, Survey tools and Techniques (Gyros, Magnetometers, Accelerometers), MWD technology, Torque and Drag Modeling, Buckling and Post Buckling analysis, Rotary Steerable systems, Hole cleaning in vertical wells, Hole cleaning in directional wells, Wellbore Stability, Cementing (floating casing, horizontal well cementing), Completions (gravel packing, unconventional wells), Hydraulics (effect of eccentricity)
Americans with Disabilities Act (ADA)
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Academic Integrity
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Course Description: The purpose of this course is to integrate the necessary fundamentals from flow in porous media, elasticity theory, fracture mechanics and fluid mechanics in order to understand, design, optimize and evaluate hydraulic fracturing treatments. Our goal is to establish a unified design and analysis methodology for propped fracturing. Starting from the reservoir engineering description of the performance of a fractured well, we provide a firm basis for determining the optimum fracture dimensions based on the effective Proppant Number concept. Technical constraints will be satisfied in such a way that the design will depart from the theoretical optimum only to the necessary extent. We discuss fluid, proppant and rock properties, data gathering, design models of various complexity, on-site calibration, real-time and post-job data evaluation, in addition to deriving and solving models of fracture propagation. In this course we put special emphasis on using the computer not just as a number-crunching device but rather to do all kind of mathematical derivations and advanced algorithms. Therefore, approximately one third of the course will be devoted to the use of the Mathematica (MMA) software.

Textbooks: The course material is a not covered in one unique textbook. Materials will be provided in electronic form, downloadable via eCampus.

Software: The software system Mathematica 9 (http://www.wolfram.com/siteinfo; http://www.wolfram.com/mathematica/how-to-buy/education/students.html) should be installed on the computer you are working on.

Grading Policy: Regular university scale will be applied (A: 90-100, B: 80-90-,... )

<table>
<thead>
<tr>
<th>Section</th>
<th>Credit</th>
<th>Days</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>3</td>
<td>MWI 12:40-01:30</td>
<td>Lectures</td>
<td>RICH 208</td>
</tr>
<tr>
<td>700 (DL)</td>
<td>3</td>
<td>NA WEB</td>
<td>Lectures</td>
<td>NA</td>
</tr>
<tr>
<td>720 (DL)</td>
<td>3</td>
<td>NA WEB</td>
<td>Lectures</td>
<td>NA</td>
</tr>
</tbody>
</table>

Remark: Based on your semester performance and project I will offer a grade. If you opt not to accept, the project grade will be completely dropped and the last 30 % will come totally from the Final Exam.

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Additional information http://student-rules.tamu.edu
## Class Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-13</td>
<td>M</td>
<td>Introduction to the course, Introduction to fracturing</td>
</tr>
<tr>
<td>1-15</td>
<td>W</td>
<td>MMA: Introduction: How To and Concepts</td>
</tr>
<tr>
<td>1-17</td>
<td>F</td>
<td>MMA: Simple problem solving, plots and lists.</td>
</tr>
<tr>
<td>1-20</td>
<td>M</td>
<td>MLK day, no class</td>
</tr>
<tr>
<td>1-22</td>
<td>W</td>
<td>Production Forecast: Theoretical calculations of PI; Optimum Fracture Dimensions</td>
</tr>
<tr>
<td>1-24</td>
<td>F</td>
<td>MMA: Naming and scoping, building up calculation sequences;</td>
</tr>
<tr>
<td>1-27</td>
<td>M</td>
<td>Linear Elasticity and Rock Mechanics: Stresses in formations</td>
</tr>
<tr>
<td>1-29</td>
<td>W</td>
<td>Ideal Crack Shapes</td>
</tr>
<tr>
<td>1-31</td>
<td>F</td>
<td>MMA: Symbolics and equation solving; Calculation of crack shapes</td>
</tr>
<tr>
<td>2-03</td>
<td>M</td>
<td>Rheology, Fluid flow in fractures; Proppant transport</td>
</tr>
<tr>
<td>2-05</td>
<td>W</td>
<td>Coupling of elasticity and flow – 2D design</td>
</tr>
<tr>
<td>2-07</td>
<td>F</td>
<td>MMA: More on symbolics; Solving rheology problems</td>
</tr>
<tr>
<td>2-10</td>
<td>M</td>
<td>Bulk fluid loss concepts; Material balance</td>
</tr>
<tr>
<td>2-12</td>
<td>W</td>
<td><strong>Midterm Exam 1</strong></td>
</tr>
<tr>
<td>2-14</td>
<td>F</td>
<td>MMA: Interpolation and regression; Derivation of G-function,</td>
</tr>
<tr>
<td>2-17</td>
<td>M</td>
<td>On-Site Injection Test, Minifrac analysis</td>
</tr>
<tr>
<td>2-19</td>
<td>W</td>
<td>MMA: More on Interpolation and regression and visualization; Minifrac analysis</td>
</tr>
<tr>
<td>2-21</td>
<td>F</td>
<td>MMA: Programming concepts; Design variants 1.</td>
</tr>
<tr>
<td>2-24</td>
<td>M</td>
<td>Height</td>
</tr>
<tr>
<td>2-26</td>
<td>W</td>
<td>MMA: More on programming concepts; Fracture height.</td>
</tr>
<tr>
<td>2-28</td>
<td>F</td>
<td>MMA: More on programming concepts; Design variants 2</td>
</tr>
<tr>
<td>3-03</td>
<td>M</td>
<td>Modeling fracture propagation in 3D</td>
</tr>
<tr>
<td>3-05</td>
<td>W</td>
<td>Commercial software - FracPro, MFRAC</td>
</tr>
<tr>
<td>3-07</td>
<td>F</td>
<td>MMA: More on programming concepts; Design variants 3</td>
</tr>
<tr>
<td>3-10</td>
<td>M</td>
<td><strong>Spring break, no class</strong></td>
</tr>
<tr>
<td>3-12</td>
<td>W</td>
<td>Spring break, no class</td>
</tr>
<tr>
<td>3-14</td>
<td>F</td>
<td>Spring break, no class</td>
</tr>
<tr>
<td>3-19</td>
<td>W</td>
<td><strong>Midterm Exam 2</strong></td>
</tr>
<tr>
<td>3-21</td>
<td>F</td>
<td>Treatment data analysis and diagnostics</td>
</tr>
<tr>
<td>3-24</td>
<td>M</td>
<td>MMA: Optimization; Frac design with non-darcy effect</td>
</tr>
<tr>
<td>3-26</td>
<td>W</td>
<td>Acid fracturing</td>
</tr>
<tr>
<td>3-28</td>
<td>F</td>
<td><strong>Reading day, no class</strong></td>
</tr>
<tr>
<td>3-31</td>
<td>M</td>
<td>MMA: More on data visualization; Barnett Shale</td>
</tr>
<tr>
<td>4-02</td>
<td>W</td>
<td>Diagnostics,</td>
</tr>
<tr>
<td>4-04</td>
<td>F</td>
<td>Horizontal well fracturing, Shale fracturing</td>
</tr>
<tr>
<td>4-07</td>
<td>M</td>
<td>Materials necessary for projects</td>
</tr>
<tr>
<td>4-09</td>
<td>W</td>
<td><strong>Midterm Exam 3</strong></td>
</tr>
<tr>
<td>4-11</td>
<td>F</td>
<td>Pseudo-steady and transient productivity calculation methods</td>
</tr>
<tr>
<td>4-14</td>
<td>M</td>
<td>MMA: Multiprecison; Numerical Laplace inversion</td>
</tr>
<tr>
<td>4-16</td>
<td>W</td>
<td>MMA: Parallel evaluation; Time domain performance toolkit</td>
</tr>
<tr>
<td>4-18</td>
<td>F</td>
<td><strong>Reading Day. No class.</strong></td>
</tr>
<tr>
<td>4-21</td>
<td>M</td>
<td>Project presentations</td>
</tr>
<tr>
<td>4-23</td>
<td>W</td>
<td>Project presentations</td>
</tr>
<tr>
<td>4-25</td>
<td>F</td>
<td>Project presentations</td>
</tr>
<tr>
<td>4-28</td>
<td>M</td>
<td>Project presentations</td>
</tr>
<tr>
<td>4-29</td>
<td>T</td>
<td>(Redefined: F classes) Project presentations</td>
</tr>
<tr>
<td>5-05</td>
<td>M</td>
<td>(10:30 am - ) Final exam (if not waived)</td>
</tr>
</tbody>
</table>

1-17: F. 5 pm Last day for adding/dropping courses; 4-01: T. 5 pm Last day of Q-drop; 5-02: Offered grades due
PETE 630: Geostatistics

Course Outline
• 1  Overview & Objectives

• 2  Basic Review of Probability and Statistics
  – Distribution functions
  – Moments and Expectations
  – Covariance/correlation

• 3  Data Correlation/Regression
  – Multivariate Analysis (PCA, Cluster and Discriminant Analysis)
  – Data classification/partitioning
  – Parametric and Non-parametric Regression
4 Spatial Interpolation of Properties
   – 4.1 Variogram and Variogram Modeling
   – 4.2 Linear Regression
   – 4.3 Kriging/Cokriging
   – 4.4 Kriging/Cokriging Variations

5 Stochastic Simulation
   – 5.1 Conditional Simulation
   – 5.2 Sequential Simulation
   – 5.3 Simulated Annealing
   – 5.4 Uncertainty Assessment
• 6 Integration of seismic and Well Data
  – 6.1 Scales and resolution
  – 6.2 Sequential Simulation with Block Kriging
  – 6.3 Bayesian Approaches
  – 6.4 Geostatistical Inversion

• 7 Modeling Facies Variations
  – 7.1 Lithofacies characterization
  – 7.2 Object-based modeling
  – 7.3 Indicator methods
• 8  Advanced Concepts
  – 8.1  Multipoint Geostatistics
  – 8.2  Markov Random Fields
  – 8.3  Fractured Reservoir Characterization

• 9  Flow Simulation in Geological Models
  – 9.1  Streamline techniques
  – 9.2  Model ranking
  – 9.3  Upscaling

• 10  Dynamic Data Integration
  – 10.1  History Matching
  – 10.2  Inverse Modeling Preliminaries
Grading Policy

• Two Examinations
  – Midterm (15%)
  – Final (15%)

• Assignments
  – Periodic class assignments (10%)

• Two Projects
  – Midterm (20%)
  – Final (30%)
Additional Reading


Petroleum Engineering 631 — Petroleum Reservoir Description  
Syllabus and Administrative Procedures  
Spring 2014

Instructor:  
Instructor: Thomas A. Blasingame, Professor  
Office: RICH 821A  
Lecture: *MW 19:00-20:15 RICH 1009  
Office Hours: Please use e-mail — t-blasingame@tamu.edu  

* This will primarily be a remote-learning/self-study course, we will only meet infrequently and I will notify you of dates for course meetings. All lectures will be recorded and archived. We will only meet for class when you are notified in writing by the instructor (i.e., you will be notified by e-mail if we are meet in class on a given date) — do not attend class unless you are instructed to do so. For reference, class will meet formally in RICH 1009 on 13 and 15 January 2014.

Texts:  
At present, there is no comprehensive text for this course — we will use journal articles, conference papers, and presentations — as well as other materials which support the topics considered in the course.

Reference Materials:  
1. Course materials for this semester are located at:  
   http://www.pe.tamu.edu/blasingame/data/P631_14A/  
2. Various articles/presentations/etc. (to be made available in electronic formats)

Basis for Grade:  
A topical course report (in a .pdf file),  
A presentation based on the course report (appended in the SAME .pdf file as the course report),  
A recording of the professional presentation (.wmv), and  
A .zip file with all of the articles, materials, presentations, used to prepare their topical report 90%  
Participation (timeliness, demonstrated interest, etc.) 10%  
Total = 100%

Prerequisites: Approval of Instructor.

Grade Cutoffs: (Percentages)  
A: > 90  B: 89.99 to 80  C: 79.99 to 70  D: 69.99 to 60  F: < 59.99

Policies and Procedures:  
1. Students are expected to keep pace in the course — PLEASE DO NOT FALL BEHIND IN THE LECTURES OR YOUR ASSIGNMENTS.  
2. Policy on Grading  
   a. Coursework is graded on the basis of answers — partial credit is at the discretion of the instructor.  
   b. All work requiring calculations shall be properly and completely documented for credit.  
   c. Grading will be performed by the instructor, or under his supervision — instructor's grading is final.  
3. Policy on Re-grading  
   a. Work will very rarely be considered for re-grading — partial credit (if any) is not subject to appeal.  
   b. Work which, while possibly correct, but cannot be followed, will be considered incorrect.  
   c. Grades assigned to homework problems will not be considered for re-grading.  
   d. If re-grading is necessary, the student is to submit a letter to the instructor explaining the situation that requires consideration for re-grading, the material to be re-graded must be attached to this letter. The letter and attached material must be received within one week from the date returned by the instructor.  
4. 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. If a student comes to class after homework has been turned in and after class has begun, the student's homework will be considered late and given a grade of zero. 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.  
5. Each student should review the University Regulations concerning attendance, grades, and scholastic dishonesty. In particular, anyone caught cheating on an examination or collaborating on an assignment where collaboration is not specifically authorized by the instructor will be removed from the class roster and given an F (failure grade) in the course.
Course Description:

Graduate Catalog: Engineering and geological evaluation techniques to define the extent and internal character of a petroleum reservoir; estimate depositional environment(s) during the formation of the sedimentary section and resulting effects on reservoir character.

Translation: The focus of this course will be the historical components of conventional and unconventional reservoirs (including tight gas sands) that have led to the present emphasis on "unconventional" reservoirs — primarily gas shales and liquids-rich shale reservoir systems.

Course Objectives: (as of 11 January 2014)

Primary Categories/Topics: (Topics of direct focus for this course)

- **[GEOSCI] Geoscience:**
  - Basic Concepts and Sedimentary Processes.
  - Depositional Environments (sandstone/clastics, carbonate, and shale/source rock reservoir systems).
  - Conditions for the generation of oil and natural gas.

- **[PETROP] Petrophysics:**
  - Classical relationships (Archie relations, log(k) versus φ plot, petrophysics process workflows).
  - Modern assessment (thin sections, power law correlations of porosity and permeability data, etc.).
  - k-φ correlations (application of a modified power law correlation to low permeability data).

- **[FLWBEH] Non-Laminar/Non-Darcy Flow Behavior:**
  - Forchheimer relation for high velocity flow.
  - Klinkenberg concept for gas-slippage.
  - Modern fluid mechanics (Knudsen Flow).

- **[CLAYEF] Effect of Clays (Shale) on Flow Behavior:**
  - Origin, distribution, and digenesis of clay materials.
  - Correlation of clay type with rock properties (k, φ) and rock fluid properties (p_c, k_r).
  - Clay type and distribution influence on production performance.

- **[TGSGRS] Geologic Character of Tight Gas/Shale Gas Reservoirs: (focus on North America)**
  - Tight Gas Reservoirs (concept model used for last 30 years has been repeatedly validated (water over gas)).
  - Shale Gas Reservoirs (basin-centered gas reservoirs — high temperatures and pressures, heterogeneous).
  - Capillary Influence (modern proposal is that capillarity can dominate fluid flow behavior in-situ).

- **[RESDES] Integrated Reservoir Description Processes for Low/Ultra-Low Permeability Reservoir Systems:**
  - Petrophysics Focus (Gunter, et al process emphasizes geological and petrophysical data).
  - Characterization Focus (Rushing/Newsham process adds emphasis on reservoir performance and modeling).
  - Reservoir Scale Effects (Atto/nano/micro/macro/giga-scale comparisons, average-volume modeling).

- **[RESPRF] Performance of Tight Gas and Gas/Liquid Shale Reservoirs: (Time-Rate-Pressure Analysis)**
  - Vertical Wells (presumed elliptical flow geometry somewhat validated using historical data)
  - Horizontal Multi-Fractured Wells (complex analytical/numerical models)

- **[RESEST] Reserves Estimation of Tight Gas and Gas/Liquid Shale Reservoirs: (Time-Rate Analysis)**
  - Traditional rate-time analyses (e.g., decline curve analysis).
  - Advanced rate-time models (Stretched Exponential, Power-Law Exponential, Duong, LGM, Weibull, etc.).
  - Continuous EUR method.

Secondary Categories/Topics: (Topics which may not be covered directly, but reference materials will be provided)

- **[PRDENG] Production Engineering:**
  - Role of artificial lift.
  - Issues in liquid loading.
  - Influence of field practices/operations.

- **[WELSTM] Well Stimulation:**
  - Influence of stimulation practices on production performance.
  - Well/reservoir performance optimization.
  - Alternatives to the multi-fracture horizontal well (MFHW).

- **[PVTLRS] Phase Behavior of Liquids-Rich Shale Reservoirs:**
  - Examples of fluid properties for Liquids-Rich Shale Reservoirs.
  - Relevance of traditional PVT correlations.

- **[RESMOD] Reservoir Modeling:**
  - Nano-scale flow modeling (flow in kerogen/matrix).
  - Molecular dynamics simulation (phase behavior).
  - Reservoir performance studies of shale gas/liquids-rich systems (examples from the literature).
<table>
<thead>
<tr>
<th>Week of 13 January 2014</th>
<th>Topic</th>
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</thead>
</table>
— Depositional Environments (sandstone/clastics, carbonate, and shale/source rock reservoir systems).  
— Conditions for the generation of oil and natural gas. |

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<thead>
<tr>
<th>Week of 20 January 2014</th>
<th>Topic</th>
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</thead>
</table>
| [PETROP] Petrophysics  | — Classical relationships (Archie relations, log(k) versus \( \phi \) plot, petrophysics process workflows).  
— Modern assessment (thin sections, power law correlations of porosity and permeability data, etc.).  
— \( k-\phi \) correlations (application of a modified power law correlation to low permeability data). |

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<thead>
<tr>
<th>Week of 27 January 2014</th>
<th>Topic</th>
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</table>
— Klinkenberg concept for gas-slippage.  
— Modern fluid mechanics (Knudsen Flow). |

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<tr>
<th>Week of 03 February 2014</th>
<th>Topic</th>
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</table>
— Correlation of clay type with rock properties \((k, \phi)\) and rock fluid properties \((p_c, k_r)\).  
— Clay type and distribution influence on production performance. |

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<thead>
<tr>
<th>Week of 10 February 2014</th>
<th>Topic</th>
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</table>
| [TGSGRS] Geologic Character of Tight Gas/Shale Gas Reservoirs: (focus on North America) | — Tight Gas Reservoirs (concept model used for last 30 years has been repeatedly validated (water over gas)).  
— Shale Gas Reservoirs (basin-centered gas reservoirs — high temperatures and pressures, heterogeneous).  
— Capillarity Influence (modern proposal is that capillarity can dominate fluid flow behavior in-situ). |

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<tr>
<th>Week of 17 February 2014</th>
<th>Topic</th>
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</table>
— Characterization Focus (Rushing/Newsham process adds emphasis on reservoir performance and modeling).  
— Reservoir Scale Effects (Atto/nano/micro/macro/giga-scale comparisons, average-volume modeling). |

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<tr>
<th>Week of 24 February 2014</th>
<th>Topic</th>
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</table>
| [RESPRF] Performance of Tight Gas and Gas/Liquid Shale Reservoirs: (Time-Rate-Pressure Analysis) | —Vertical Wells (presumed elliptical flow geometry somewhat validated using historical data)  
— Horizontal Multi-Fractured Wells (complex analytical/numerical models) |

<table>
<thead>
<tr>
<th>Week of 03 March 2014</th>
<th>Topic</th>
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</thead>
</table>
| [RESEST] Reserves Estimation of Tight Gas and Gas/Liquid Shale Reservoirs: (Time-Rate Analysis) | — Traditional rate-time analyses (e.g., decline curve analysis).  
— Advanced rate-time models (Stretched Exponential, Power-Law Exponential, Duong, LGM, Weibull, etc.).  
— Continuous EUR method. |

<table>
<thead>
<tr>
<th>Week of 10 March 2014</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Spring Break: 10-14 March 2014</td>
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<thead>
<tr>
<th>Week of 17 March 2014</th>
<th>Topic</th>
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</table>
| [PRDENG] Production Engineering | — Role of artificial lift.  
— Issues in liquid loading.  
— Influence of field practices/operations. |

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<thead>
<tr>
<th>Week of 24 March 2014</th>
<th>Topic</th>
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</table>
— Well/reservoir performance optimization.  
— Alternatives to the multi-fracture horizontal well (MFHW). |

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<thead>
<tr>
<th>Week of 31 March 2014</th>
<th>Topic</th>
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</thead>
</table>
— Examples of fluid properties for Liquids-Rich Shale Reservoirs.  
— Relevance of traditional PVT correlations. |

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<tr>
<th>Week of 07 April 2014</th>
<th>Topic</th>
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</table>
— Molecular dynamics simulation (phase behavior).  
— Reservoir performance studies of shale gas/liquids-rich systems (examples from the literature). |

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<thead>
<tr>
<th>Week of 15 April 2014</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Closure Discussions/Final Assistance on Course Project</td>
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<thead>
<tr>
<th>Week of 22 April 2014</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>Due Date — Course Project</td>
<td></td>
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</tbody>
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Note: Do NOT attend class (RICH 1009) unless you are notified in via e-mail that class will physically meet on a particular date.

Course Assignment: (to be formally assigned in a separate document — provided here for information purposes only)

- A course report (.pdf), a topical course report (in a .pdf file),
- A presentation based on the course report (appended in the SAME .pdf file as the course report),
- A recording of the professional presentation (.wmv), and
- A .zip file with all of the articles, materials, presentations, used to prepare their topical report.
Americans with Disabilities Act (ADA) 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 Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall, or call 845-1637.

Aggie Honor Code: (http://www.tamu.edu/aggiehonor/)
"An Aggie does not lie, cheat or steal, or tolerate those who do."

Definitions of Academic Misconduct:
1. CHEATING: Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices or materials in any academic exercise.
2. FABRICATION: Making up data or results, and recording or reporting them; submitting fabricated documents.
3. FALSIFICATION: Manipulating research materials, equipment or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
4. MULTIPLE SUBMISSIONS: Submitting substantial portions of the same work (including oral reports) for credit more than once without authorization from the instructor of the class for which the student submits the work.
5. PLAGIARISM: The appropriation of another person's ideas, processes, results, or words without giving appropriate credit.
6. COMPLICITY: Intentionally or knowingly helping, or attempting to help, another to commit an act of academic dishonesty.
7. ABUSE AND MISUSE OF ACCESS AND UNAUTHORIZED ACCESS: Students may not abuse or misuse computer access or gain unauthorized access to information in any academic exercise. See Student Rule 22: http://student-rules.tamu.edu/
8. VIOLATION OF DEPARTMENTAL OR COLLEGE RULES: Students may not violate any announced departmental or college rule relating to academic matters.
9. UNIVERSITY RULES ON RESEARCH: Students involved in conducting research and/or scholarly activities at Texas A&M University must also adhere to standards set forth in the University Rules.

For additional information please see:
http://student-rules.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, 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, writings, 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."
Petroleum Engineering 632
Physical and Engineering Properties of Rock

Catalog Description:
Physical and engineering properties of rock and rock masses including strength, deformation, fluid flow, thermal and electrical properties as a function of the subsurface temperature, in-situ stress, pore fluid pressure, and chemical environment; relationship of rock properties to logging, sitting and design of wells and structures in rock.

Instructor:
Dr. I. Yucel Akkutlu
Office: 401T Richardson Building
Email: akkutlu@pe.tamu.edu
Office Hours: Tuesdays and Wednesdays between 11:00am-12:00pm

Recommended Optional Textbooks:

Topics Covered:
The following topics will be covered with emphasis on the unconventional rocks, i.e., tight gas, tight oil, shale, coal and natural gas hydrates
1. Pore space properties of rocks, porosity, permeability
2. Single-phase flow in rocks and Darcy’s equation
3. Surface tension, interfacial tension and wettability
4. Capillary pressure
5. Fluid saturations
6. Multi-phase flow in rocks and relative permeability
7. Elastic properties of rocks, rock compressibility
8. Acoustic properties of rocks
9. Rock-fluid interactions
10. Statistical analysis of reservoir data

Lecture and Practice Course Schedule
Two 1 hour 15 minutes lecture sessions each week (TR 8:00-9:15am)
Two 1 hour practice session each week (TW 3:30-4:30pm)

Student Evaluation
Practice Reports: 20%
Term Project: 20%
Midterm Examination: 30%
Final Examination: 30%

Final grade distribution will be based on the curving method but the instructor reserves the right to deviate from this approach at his discretion.
Instructor:
Dr. Akhil Datta-Gupta
Rm. 401G Richardson Building
Tel. 979-847-9030   e-mail: datta-gupta@tamu.edu

Text:
No prescribed textbook. References, papers and class notes will be provided.
Suggested Readings:
Menke, W., Geophysical Data Analysis: Discrete Inverse Theory, Academic Press Inc.

Course Overview:
This course is designed to cover techniques to incorporate diverse data types during petroleum reservoir characterization, accounting for the scale and precision associated with the data. A particular emphasis will be on the integration of dynamic reservoir behavior into stochastic reservoir characterization through the use of inverse modeling. The dynamic data can be in the form of pressure transient test, tracer test, multiphase production history or interpreted 4-D seismic information.

Prerequisites:
Permission of the instructor

Course grading (tentative):
Individual Projects (70%)
Group Projects (20%)
Class Assignments/Tests (10%)
RESERVOIR DATA INTEGRATION: PETE 633

Instructor: Dr. Akhil Datta-Gupta

Course Outline

1. Introduction and Background
2. PDF for functions of Random Variable
3. Bayes Rule as a Basis for Inverse Problems
4. Project-1: Bayes Theorem Applied to Core Data
5. Inverse Problem: An Illustration
6. The General Linear Gaussian Case
7. Solving the Inverse Problem
8. Minimization Method: Gauss Newton
9. Project-2: Integration of Well Test Data
10. Model Assessment and Uncertainty Quantification
11. Resolution and Variance of Solution
12. Project-3: Seismic Inversion
13. Computing Sensitivities (Group Project)
   a. Gradient Simulator Method
   b. Adjoint Method
14. Minimization Methods (Group Project)
   a. Conjugate Gradient Method
   b. Variable Metric Method
15. Reparameterization (Group Project)
   a. K-L Expansion
   b. Discrete Cosine Transform
   c. Grid Connectivity Based Transform
16. Ensemble Kalman Filter (Group Project)
17. Simulated Annealing/Genetic Algorithm (Group Project)
18. Sampling Posterior Distribution: MCMC
19. Experimental Design and Response Surface Methods
Description of Course
This course provides an introduction to methods for the development of reservoir models, and the analysis and integration of data required to apply these methods. It particularly emphasizes the integration of geological information into these models. Each student will give an oral report on a subject not covered in the lectures e.g., experimental design, multipoint statistics, Markov modeling, and analysis of compositional data.

Course Materials
- Statistics for Petroleum Engineers and Geoscientists by Jensen et al., 2003, Elsevier (main text)
- Stochastic Modelling and Geostatistics by Yarus and Chambers, AAPG
- Selected papers covering case studies and modelling methods
- Class note and handouts

Course Outline

<table>
<thead>
<tr>
<th>Week #</th>
<th>Topic</th>
<th>Description</th>
<th>Time</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Introduction: need for modelling, types of models, review of geological and petrophysical reservoir properties (architecture, single and two-phase properties)</td>
<td>3 hrs</td>
</tr>
<tr>
<td>2-3</td>
<td>2</td>
<td>Probability and statistics: review of univariate statistics and their links to geology, including averages, estimation error, and sample numbers</td>
<td>6 hrs</td>
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<tr>
<td>4</td>
<td>3</td>
<td>Monte Carlo methods: oil in place determination, stochastic shales, and porosity and permeability assignments</td>
<td>3 hrs</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>Bayes theorem and geology: including prior knowledge from data (seismic, outcrop), effect on estimates</td>
<td>3 hrs</td>
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<tr>
<td>5</td>
<td>Exam 1</td>
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<tr>
<td>6-8</td>
<td>5</td>
<td>Bivariate statistics: Methods for evaluation of relationship strength, assessing trends and cyclicity in data, variograms and geology</td>
<td>9 hrs</td>
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<tr>
<td>9-10</td>
<td>6</td>
<td>Kriging: basics and variations of the method, including simple, ordinary, indicator, and universal kriging</td>
<td>6 hrs</td>
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<tr>
<td>10</td>
<td>Exam 2</td>
<td></td>
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<tr>
<td>11-12</td>
<td>7</td>
<td>Facies distributions and petrophysical property assignments using pixel-based modelling: sequential gaussian and sequential indicator simulation, case study</td>
<td>6 hrs</td>
</tr>
<tr>
<td>13</td>
<td>8</td>
<td>Sedimentary body modelling using object-based methods, case study</td>
<td>1½</td>
</tr>
<tr>
<td>13</td>
<td>9</td>
<td>Fracture models: fracture properties, overview of methods to simulate fracture distributions, neural networks, case study</td>
<td>1½</td>
</tr>
<tr>
<td>14</td>
<td>10</td>
<td>Student reports</td>
<td>3 hrs</td>
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</tbody>
</table>

Course grading
- Exams (2) .......................................................................................................................................... (50%)
- Homework ........................................................................................................................................ (20%)
- Report ............................................................................................................................................... (30%)
- Total .................................................................................................................................................. (100%)

Course Instructor
TBD
Disabilities
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civil rights protection for persons with disabilities. Among other things, this legislation requires that all students
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Plagarism
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communicated.

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Rules*, http://student-rules.tamu.edu, under the section “Scholastic Dishonesty.”
Petroleum Engineering 635
Underbalanced and Managed Pressure Drilling
Syllabus
Fall 2009

Instructor: Jerome Schubert
Contact Information: Phone 979-862-1195; Email jerome.schubert@pe.tamu.edu
Office: Room 501K, Richardson Building

Description of Course: (Concise Statement of purpose of design) This course provides an introduction and application of techniques utilized in underbalanced and managed pressure drilling. Topics covered are equipment, types of drilling fluids used (air, mist foam, etc.), flow drilling, mud cap drilling and hydraulics calculations.

Text Materials:

- “Gas Volume Requirements for Underbalanced Drilling”, Guo, Boyun and Ghalambor, Ali, PennWell Corporation, Tulsa, OK, 2002

References:

- “Mudlite Air/Mist/Foam Hydraulics Model”, Maurer Engineering Inc., Houston, 1988

Course Outline: (by major topics, and approximate time for each topic)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Time</th>
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<tbody>
<tr>
<td>3</td>
<td>Selecting an Appropriate Candidate and Technique: Geophysical and Geological Aspects, Reservoir Characteristics, and Feasibility. Wellbore construction constraints, and fluid selection. Economics</td>
<td>3 hrs</td>
</tr>
<tr>
<td>4</td>
<td>Well Engineering: Circulation programs and calculations. Wellhead, casing, and completion design. Bit selection, Underbalanced perforating, and drillstring design</td>
<td>6 hrs</td>
</tr>
<tr>
<td>5</td>
<td>Special Considerations: Safety, regulatory requirements, and environmental issues. Directional, percussion, and high pressure drilling. Cementing, formation evaluation</td>
<td>4 hrs</td>
</tr>
<tr>
<td>6</td>
<td>Blowout Preventer Equipment: Primary control, rotating heads, diverters, and RBOPs. UBD well control procedures. Sour wells and other special well control considerations</td>
<td>6 hrs</td>
</tr>
<tr>
<td>7</td>
<td>Risk Management for Underbalanced Operations: Risk identification, analysis, and mitigation</td>
<td>4 hrs</td>
</tr>
<tr>
<td>8</td>
<td>Downhole Problems and Troubleshooting: Wellbore instibility, vibration, fluid influxes, stuck pipe and fishing, corrosion.</td>
<td>3 hrs</td>
</tr>
<tr>
<td>9</td>
<td>Introduction to Managed Pressure Drilling? What is MPD? Why MPD? Techniques</td>
<td>3 hrs</td>
</tr>
<tr>
<td>10</td>
<td>Dual Gradient Drilling</td>
<td>2 hrs</td>
</tr>
<tr>
<td>11</td>
<td>Microflux Drilling</td>
<td>1 hr</td>
</tr>
<tr>
<td>9</td>
<td>Well Control, drilling problems, safety and environmental issues</td>
<td>4 hrs</td>
</tr>
</tbody>
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Subtotal: 43 hrs
In-class Exams: 2 hrs
Total: 45 hrs
Course grading:
Midterm Exam................................................................. (25%)
Final Exam................................................................. (25%)
Homeworks................................................................. (25%)
Project................................................................. (25%)

ADA Policy Statement: (Texas A&M University Policy Statement)

Americans with Disabilities Act (ADA) Policy Statement

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the UCC by the Department of Student Life. The policy statement was forwarded to the Faculty Senate for information.

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Suggested for Inclusion in Your First Day Handout or Syllabus

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, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyright-ed, 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, writings, 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 Code of Honor

An Aggie does not lie, cheat, or steal or tolerate those who do.
PETE 636 Horizontal, Multilateral and Intelligent Wells

Textbook Required: *Multilateral Wells*, A.D. Hill, Ding Zhu and Michael J. Economides
Supplemental Material: SPE papers

**Course Lecture Schedule**

**Unit 1: Complex Well Performance**

1/14   Introduction, course outline, method of study
       Assignment: Read Chapter 3, and 4

1/16   Horizontal well performance model: Steady State
       Joshi model, Furui model
       Assignment: Read Chapter 5

1/21   Horizontal well performance model: Pseudo Steady-State
       Babu and Odeh model
       Assignment 1: horizontal wells model for productivity calculation

1/23   Class exercise: sensitivity study of horizontal well design

1/28   Segment model of horizontal well performance
       Assignment 2: segment model

1/30   Gas well model and two-phase correlation
       Assignment 2: Baba and Odeh model for productivity calculation

2/4, 2/6 No class

   Project 1: computer program for horizontal well performance

2/11   Multilateral well applications, junction classification

2/13   Multilateral productivity calculation

   **Project 1 due (25%)**

**Unit 2: Completion and Intelligent Wells**

2/18   Horizontal well completion: formation damage model, completion design and selection

2/20   Horizontal well completion model
       Assignment 3: optimal design of horizontal well completion

2/25   Cross flow and flow control in multilateral wells

2/27   Intelligent completion for optimization: ICD /ICV
       Assignment 4: ICD design and evaluation
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>Intelligent completion: monitoring flow</td>
</tr>
<tr>
<td>3/6</td>
<td>Reservoir and well optimization by intelligent completion</td>
</tr>
<tr>
<td></td>
<td>Project 2: Optimization of horizontal completion design</td>
</tr>
<tr>
<td>3/10-14</td>
<td>Spring Break</td>
</tr>
</tbody>
</table>

**Project 2 due (25%)**

**Unit 3: Acidizing of Horizontal Wells**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/18</td>
<td>Carbonate acidizing overview, wormhole modeling</td>
</tr>
<tr>
<td>3/20</td>
<td>Horizontal well acidizing model</td>
</tr>
<tr>
<td></td>
<td>Assignment 4: paper review</td>
</tr>
<tr>
<td>3/25</td>
<td>Completion for horizontal well acidizing: acid placement</td>
</tr>
<tr>
<td>3/27</td>
<td>Horizontal well acidizing design, optimal injection condition</td>
</tr>
</tbody>
</table>

**Paper review due (10%)**

**Unit 4: Horizontal Well Fracturing**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/1</td>
<td>Horizontal well fracturing overview</td>
</tr>
<tr>
<td>4/3</td>
<td>Horizontal fracture models</td>
</tr>
<tr>
<td>4/8</td>
<td>Horizontal fracture models</td>
</tr>
<tr>
<td></td>
<td>Final project</td>
</tr>
<tr>
<td>4/10</td>
<td>Multiple fracture placement</td>
</tr>
<tr>
<td>4/15</td>
<td>Horizontal well fracturing: complex fracture network system</td>
</tr>
<tr>
<td>4/17</td>
<td>Class exercise: fracture well performance</td>
</tr>
<tr>
<td>4/22</td>
<td>Fractured horizontal well diagnosis</td>
</tr>
<tr>
<td>4/24</td>
<td>Project presentation</td>
</tr>
</tbody>
</table>

**Final project due (40%)**
Course title and number  PETE 637 Streamline Simulation
Term  Fall 2013
Meeting times and location  M 3:00-6:00 PM, RICH 313

Course Description and Prerequisites
This course is designed to cover introductory and advanced concepts in streamline simulation and its applications. The theory of streamlines/streamtubes in multidimensions is reviewed. The specific topics include: Streamline, Streamtubes, Streamfunctions. Transport Along Streamlines. Spatial Discretization and Material Balance. Time Stepping and Transverse Fluxes. Impact of Cell Geometry. History Matching and Production Data Integration. Comparison with Finite Difference. Prerequisites: Graduate Classification

Learning Outcomes or Course Objectives
The objective of the course is to familiarize the students with the introductory and advanced concepts in the theory and applications of the rapidly evolving streamline simulation technology. At the end of this class, students will be familiar with modern streamline simulators, their advantages and limitations compared to traditional finite difference models.

Instructor Information
Name  Dr. Akhil Datta-Gupta
Telephone number  (979) 847-9030
Email address  datta-gupta@tamu.edu
Office hours
Office location  Rm401G  Richardson Building

Textbook and/or Resource Material
No Required Textbook.
Available from the Society of Petroleum Engineers. (http://store.spe.org/)

Grading Policies
Midterm Exam.................................................................(20%)
Final Exam.................................................................(30%)
Class Projects/Homeworks..............................................(50%)
# Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Required Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>The Role of Streamline Simulation, Historical Precedents, Chronological development</td>
</tr>
<tr>
<td>2</td>
<td>Basic Governing Equations</td>
<td>General Conservation Equations, Pressure Equation, Treatment of Sources and Sinks</td>
</tr>
<tr>
<td>3-4</td>
<td>Streamline, Streamtubes, Streamfunctions</td>
<td>Streamfunctions and Complex Potential, Streamtubes, Streamlines and Time of Flight, Compressible Flow</td>
</tr>
<tr>
<td>5</td>
<td>Transport Along Streamlines</td>
<td>Analytical Solutions, Semianalytic Solution, and Numerical Solutions</td>
</tr>
<tr>
<td>7</td>
<td>Time Stepping and Transverse Fluxes</td>
<td>Concepts of Operator Splitting, Modeling Gravity, Modeling Capillarity and Transverse Dispersion, and Modeling Fractured Reservoirs</td>
</tr>
<tr>
<td>8-9</td>
<td>Impact of Cell Geometry</td>
<td>Corner-Point Extension and Impact on Displacement Calculations</td>
</tr>
<tr>
<td>10-11</td>
<td>History Matching and Data Integration</td>
<td>Assisted History Matching, Automatic History Matching, Streamline and Asymptotic Ray Theory, Sensitivity Computations Using Streamline Models, and Production Data Integration into High-Resolution Models</td>
</tr>
<tr>
<td>14-15</td>
<td>Field Studies 2: Advanced</td>
<td>Flow Visualization/sector models, Fast Runs, Ranking and Uncertainty Assessment, Upgridding/grid design, Upscaling QC, Pseudoization, and History Matching</td>
</tr>
</tbody>
</table>
Other Pertinent Course Information

Americans with Disabilities Act (ADA)

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Academic Integrity

For additional information please visit: http://www.tamu.edu/aggiehonor

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Course title and number  PETE 638 - Production Logging
Term (e.g., Fall 200X)  Spring 2010
Meeting times and location  11:10 a.m. – 12:25 p.m. TR, RICH 302

Course Description and Prerequisites
This course will cover fluid flow in pipes, the theoretical basis of production logging techniques, production log interpretation techniques, and operational considerations. Production Logging has been described as “that area of well logging concerned with two general goals: (1) problem well diagnosis, and (2) reservoir surveillance.” Production logging refers to a suite of logs that are run normally on completed injection or production wells to evaluate the performance of the well itself or of the reservoir as a whole. Many of these logs measure properties of the fluid in the wellbore, rather than formation properties as in openhole logging. An understanding of the fluid dynamics in a wellbore is an important part of understanding production logs.

Graduate classification.

Learning Outcomes or Course Objectives
The objectives of the course are for students to:
1. Gain an overall understanding of the fluid flow in pipes, the theoretical basis of production logging techniques, production log interpretation techniques, and operational considerations.
2. Learn about the fluid dynamics in a wellbore as an important part of understanding production logs.
3. Understand production logging as that area of well logging concerned with two general goals: (1) problem well diagnosis, and (2) reservoir surveillance.

Instructor Information
Name  TBD
Telephone number
Email address
Office hours
Office location

Textbook and/or Resource Material
Production Logging: Theoretical and Interpretive Elements, Society of Petroleum Engineers, 1990

Grading Policies
 Homework ............................................................(20%)  
Mid-term Exam. ....................................................(25%)  
Class Project .....................................................(20%)  
Final Exam. .......................................................(35%)  
Total.................................................................(100%)  

Grading Scale
A. .................................................................90-100%
B. .................................................................80-89%
C. .................................................................70-79%
D. .................................................................60-69%
F. .................................................................0-59%
### Course Topics, Calendar of Activities, Major Assignment Dates

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Required Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single Phase Flow Production Logs - Single Phase Flow in Pipes</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Temperature Logs</td>
<td></td>
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<tr>
<td>3</td>
<td>Radioactive Tracer Logs</td>
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</tr>
<tr>
<td>4</td>
<td>Spinner Flowmeters</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Multiphase Flow Production Logs - Multiphase Flow in Pipes – flow regime, holdup correlations</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Spinner Flowmeters in Multiphase Flow</td>
<td></td>
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<tr>
<td>7</td>
<td>Packer, Basket Flowmeters</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Density Logs</td>
<td></td>
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<tr>
<td>9</td>
<td>Capacitance Logs</td>
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<tr>
<td>10</td>
<td>Pipe Inclination Effects</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Noise Logging</td>
<td></td>
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<tr>
<td>12</td>
<td>Completion Evaluation Logs-Cement Bond Logs</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Cement Evaluation (Pulse-Echo) Logs</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Specialty Logs</td>
<td></td>
</tr>
</tbody>
</table>

### Other Pertinent Course Information

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#### Academic Integrity

For additional information please visit: [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor)

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
**PetE640:** Design and development of models for the simulation of flow and transport of fluids and heat in porous media (4 credits)

**OBJECTIVE**
Beginning from basic principles and based on a “starter” code that will be provided by the instructor, the students in this course will design and build numerical simulators that describe the flow of reservoir fluids and the transport of heat through porous media. At the end of this course (the first of a two-course series), the non-isothermal multi-dimensional models that will be developed will be capable of handling single mass components (gas, oil or water) in single phases (liquid or vapor).

**COURSE OUTLINE**
- Fundamental equations of flow and transport of mass and heat through porous media; the Integral Final Difference (IFD) method
- Brief overview of simulation approaches in the analysis of coupled non-linear processes
- Discussion of the fully implicit method (Jacobian and Newton-Raphson method)
- Brief overview of programming in FORTRAN95/2003 – Principles of Object-Oriented Programming (OOP)
- Simulator design – modular OOP approach
- Domain discretization (Cartesian and cylindrical)
- Process description:
  - Fluid flow (Darcy and non-Darcy flow, diffusive flow)
  - Heat transport (conduction, advection)
  - Equation of state (PVT relationships, no phase changes)
  - Thermophysical properties (phase density, viscosity, solubility, thermal conductivity, etc.)
- Initial and boundary conditions – primary and secondary variables
- Treatment of sources and sinks (wells)
- Setting up the Jacobian matrix
- Solution of the matrix equation (linear algebra, direct and iterative solvers)
- Solution of 1D, 2D and 3D problems (Cartesian or cylindrical) of isothermal/non-isothermal oil flow
- Solution of 1D, 2D and 3D problems (Cartesian or cylindrical) of isothermal/non-isothermal gas flow
  - **If time permits:** Solution of 1D, 2D and 3D problems (Cartesian or cylindrical) of isothermal/non-isothermal water flow

**PREREQUISITES**
- PetE 603/604
- Programming experience in FORTRAN95, C, C++ or another programming language (NOTE: The extensive coding effort in PetE 640 will be conducted using FORTRAN95/2003. Experience in FORTRAN or another programming language is a MUST for this course. Experience with MatLab or Mathematica programming will
be useful, but generally will not be adequate preparation for the needs of this course (extra effort to master FORTRAN programming will be necessary).

- A solid understanding of (a) the physical processes of flow and transport through porous media, (b) numerical analysis and (c) linear algebra
- Access to a FORTRAN95/2003 compiler on a PC or workstation

GRADING

- 100% homework (daily assignments); quality and logical thoroughness of code
- Policy on homework
  - All homework is due (even if late); otherwise, an “Incomplete” grade will be given until homework is submitted

ATTENDANCE

- Two class meetings each Monday (5+ hours total)
- The morning meeting will focus on discussion of (a) potential problems/difficulties of the previous assignment, and (b) the issues to be addressed in the new assignment.
- The evening meeting will focus on review of progress and troubleshooting of the current day’s assignment.
- The instructor will be available for personal discussions/appointments with the students 9 hours each Monday (10 am to noon, 1:00 pm to 4:00 pm, 8 pm to midnight), and 5 hours each Tuesday (7:00 am to noon). The instructor will also be available for telephone/e-mail discussions and consultations (as needed) during the rest of the week.

CLASS TEXTBOOK


Class notes and copies of appropriate scientific publications on relevant subjects will be distributed by the instructor.

USEFUL REFERENCES

PetE 641: Model design and development for the simulation of advanced coupled processes in geologic media (4 credits)

OBJECTIVE
This course is a continuation of the PetE640 course. The single-component, single-phase simulators developed in PetE640 are expanded to include advanced multi-phase flow processes and more complex geologic media. At the end of this course, the non-isothermal multi-dimensional models that will be developed will be capable of handling complex geologic media (porous and fractured, with matrix-fracture interactions), structured and unstructured grids, multiple mass components (gas, oil and water) in multi-phase (liquid, vapor and/or liquid-vapor) states, and phase changes.

COURSE OUTLINE
- Complex geologic media: matrix-fracture interactions in fractured media, and the Multiple Interacting Continua (MINC) concept
- Domain discretization (Mixed Cartesian/cylindrical grids, unstructured grids)
- Process description:
  - Wettability (relative permeability and capillary pressure, various models)
  - Equation of state with phase changes (PVT relationships, vapor pressure, phase enthalpies and latent heats of vaporization/condensation)
  - Thermophysical properties (phase density, viscosity, solubility, thermal conductivity, etc.)
  - Phase changes (boiling, vaporization), solution and exsolution
- Initial and boundary conditions – primary and secondary variables, primary variable change
- Treatment of sources and sinks (wells)
- Setting up the Jacobian matrices; change of primary variables
- Solution of 2D and 3D problems (Cartesian or cylindrical) of single-component (CH4), single-phase gas flow in fractured media (application to shale gas)
- Solution of 2D and 3D problems (Cartesian or cylindrical) of single-component (water), two-phase flow with phase changes (geothermal reservoir problem)
- Solution of 1D, 2D and 3D problems (Cartesian, cylindrical, mixed, Voronoi or unstructured grids) of two-component, two-phase isothermal flow (water+oil, oil+gas, water+gas)
- Solution of 1D, 2D and 3D problems (Cartesian, cylindrical, mixed, Voronoi or unstructured grids) of three-component, three-phase isothermal flow (water+oil+gas)
- Solution of 1D, 2D and 3D problems (Cartesian, cylindrical, mixed, Voronoi or unstructured grids) of three-component, three-phase non-isothermal flow with heat and phase changes (water+oil+gas, steam injection)
- Advanced problems (discussion of approach, coding only if time permits):
  - Coalbed methane
  - Solute/reactive transport

PREREQUISITES
- PetE 640 (It is impossible to take this course without having first taken 640)
• Programming experience in FORTRAN95, C, C++ or another programming language
  (NOTE: The extensive coding effort in PetE 640 and 641 will be conducted using
  FORTRAN95/2003. Experience in FORTRAN or another programming language is
  a MUST for this course. Experience with MatLab or Mathematica programming will
  not be adequate preparation for the needs of this course).
• A solid understanding of (a) the physical processes of flow and transport through
  porous media, (b) numerical analysis and (c) linear algebra
• Access to a FORTRAN95/2003 compiler on a PC or workstation

GRADING
• 100% homework (daily assignments); quality and logical thoroughness of code
• Policy on homework
  o All homework is due (even if late); otherwise, an “Incomplete” grade will be
    given until homework is submitted

ATTENDANCE (for summer course)
• Twice-daily class meetings (5+ hours total)
• The morning meeting is mandatory and will focus on discussion of (a) potential
  problems/difficulties of the previous day assignment, and (b) the issues to be
  addressed in that day’s assignment
• The evening meeting will focus on review of progress and troubleshooting of the
  current day’s assignment

CLASS TEXTBOOK
will be the basic FORTRAN 95/2003 reference used in the class.

Class notes and copies of appropriate scientific publications on relevant subjects will be
distributed by the instructor.

USEFUL REFERENCES
(1) *Petroleum Reservoir Simulations: A Basic Approach*, by M. R. Islam, S. M.
(2) *Petroleum Reservoir Simulation*, by Khalid Aziz and Antonin Settari (1979)
(3) *The Properties of Petroleum Fluids*, by W.D. McCain
(4) *The Properties of Gases and Liquids*, by Bruce E. Poling, John M. Prausnitz
    and John O’Connell (2000)
(5) *Fortran 95/2003 Explained (Numerical Mathematics and Scientific
Course title and number: PETE 689-1 Formation Damage: Mechanisms and Remediation
Term (e.g., Fall 200X): Summer 2010
Meeting times and location: TR 2:00-5:00 PM, RICH 208

Course Description and Prerequisites
Formation damage can occur in oil and gas wells during drilling, completion, or even following chemical treatments. It adversely impact well performance and significantly affects the economics of damaged wells. It is essential to understand various mechanisms that cause formation damage before applying any chemical treatments. This course is designed to explain: (1) how to identify field problems, then (2) how to solve them. It is important to understand how cleaning fluids will interact with the formation brines, rock and oil. Improper design of chemical treatments can result in a new and more difficult type of damage to remove. This course will cover and explain in detail mechanisms of formation damage that can occur during drilling, completion, and following chemical treatments. Finally, the course will address chemical treatments to remove various types of damage. Field examples will be given to highlight the mechanism of damage, and the best method to remove it.

Learning Outcomes or Course Objectives
The main objective of this course is to highlight the importance of formation damage and how it impact well performance. Oil, gas and water supply wells are damaged during their life time. Various types of damage can occur during drilling, completion and production. Identification of damage type and location is the first step in designing chemical treatment to remove formation damage. Well completion, bottomhole conditions, and type of fluids in the wellbore should be also considered. Failure to consider these parameters will result in more damage than originally thought. Field cases will be discussed in the class to reinforce the importance of problem identification and fluid selection that takes into account downhole pumps and well tubulars.

Instructor Information
Name: H.A. Nasr-El-Din
Telephone number: (979) 862-1473
Email address: hisham.nasreldin@pe.tamu.edu
Office hours: Monday and Wednesday: 10:20-11:10 and 11:30-12:20 PM
Office location: 610 Richardson

Textbook and/or Resource Material
Several textbooks will be used, including, but not limited to:
Reservoir Formation Damage, F. Civan, 2000
Emulsions: Fundamentals and Applications in the Oil Industry, L.L. Schramm, 2000
Technology for Cleaning Industrial Equipment, W. W. Frenier, 2001

Grading Policies
Mid term exam: 30%
Class Project: 30%
Final Exam: 40%

Course Topics, Calendar of Activities, Major Assignment Dates
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Required Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>Definitions, impact of well performance, skin damage, and how to measure it in the field</td>
</tr>
<tr>
<td>2</td>
<td>Clays and Feldspars</td>
<td>Structures and chemical composition of various clays and feldspars, types of clays and how they impact well performance</td>
</tr>
<tr>
<td>3</td>
<td>Fines Migration, Clay Swelling and Clay Stabilizers</td>
<td>Fines migration and permeability decline, coreflood experiment to determine critical salt concentration, impact of pH on migration and swelling of clays, cationic polymers as clay stabilizers</td>
</tr>
<tr>
<td>4</td>
<td>Damage due to Drilling and Completion Fluids and Injection Waters</td>
<td>Types of drilling and completion fluids, filter cake characteristics, and various methods to remove it, water blockage, surface tension of completion fluids, surfactants to reduce surface tension</td>
</tr>
<tr>
<td>5</td>
<td>Damage due to Perforation</td>
<td>How to perforate various wells, perforation and its impact on well performance, damage due to perforation</td>
</tr>
<tr>
<td>6</td>
<td>Damage due to Organic Deposition</td>
<td>Asphaltenes, Waxes, and Naphtanantes, Mechanisms of Organic Deposition, Removal, and Mitigation. Damage due to suspended solids and bacteria</td>
</tr>
<tr>
<td>7</td>
<td>Damage due to Inorganic Scale</td>
<td>Types of scales encountered in oilfield, Mechanisms of scale formation, Scale Removal Methods Radioactive Tracer Logs, and Scale Mitigation Treatments</td>
</tr>
<tr>
<td>8</td>
<td>Damage due to EOR</td>
<td>Damage due to alkaline flooding, damage due to CO2 flooding, damage due to polymer flooding, damage due to steam flooding</td>
</tr>
<tr>
<td>9</td>
<td>Damage due to Chemical Treatments</td>
<td>Damage due to scale squeeze treatment, damage due to mud acid treatments, damage due to additives</td>
</tr>
<tr>
<td>10</td>
<td>Damage Removal</td>
<td>Various chemical treatments available to remove various types of damage. Chemicals used in damage removal will be discussed, including acids, oxidizers, chelating agents, enzymes and combinations of these chemicals.</td>
</tr>
</tbody>
</table>

**Other Pertinent Course Information**

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Academic Integrity
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PETE 643 - Oil Field Chemistry

Course Description and Prerequisites
The role of chemistry in well stimulation, water shut-off treatments, scale removal, mitigation, downhole corrosion issues, organic deposition, denuving, drilling fluids and various aspects of formation damage; includes problem identification as the first step in designing chemical treatment to remove formation damage.
Prerequisite: Graduate classification

Learning Outcomes or Course Objectives
The objectives of this course are for students to:

1. Highlight the importance of chemistry in well treatments. Oil, gas and water supply wells are damaged during their life time. Various types of damage can occur during drilling, completion and production.
2. Identify problems as the first step in designing chemical treatment to remove formation damage. Well completion, and type of fluids in the wellbore should be also considered. Failure to consider these parameters will result in more damage than originally thought.
3. Discuss field cases to reinforce the importance of problem identification and fluid selection that takes into account downhole equipment and well tubulars.

Instructor Information
Name: H.A. Nasr-El-Din
Telephone number: (979) 862-1473
Email address: hisham.nasreldin@pe.tamu.edu
Office hours: TBD
Office location: 610 Richardson

Textbook and/or Resource Material
Several textbooks will be used, including, but not limited to: Corrosion and Scale Handbook, J.R. Becker, 1998
Technology for Cleaning Industrial Equipment, W. W. Frenier, 2001
Chemicals for Oil Field Operations, J. I. DiStasio, 1981
Well Treatments and Water Shut-off by Polymer Gels, L.J. Zitha, 2000
Surfactants Fundamentals and Applications in the Oil Industry, L.L. Schramm, 2000
Grading Policies

Homework ...................................................................(40%)
Class Presentations ...................................................................(30%)
Final Exam .............................................................................(30%)
Total......................................................................................(100%)

Grading Scale

A .........................................................................................90-100%
B .........................................................................................80-89%
C .........................................................................................70-79%
D .........................................................................................60-69%
F .........................................................................................0-59%

Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Required Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Inorganic Scale</td>
<td>Types of scales encountered in oilfield, Mechanisms of scale formation, Scale Removal Methods Radioactive Tracer Logs, and Scale Mitigation Treatments</td>
</tr>
<tr>
<td>3-4</td>
<td>Organic Deposition</td>
<td>Asphaltenes and Waxes, Mechanisms of Organic Deposition, Removal of Organic Deposition, and Mitigation of Organic Deposition</td>
</tr>
<tr>
<td>5-7</td>
<td>Corrosion in the Oil Field</td>
<td>Review of corrosion theory, Corrosion protection during well stimulation, Corrosion protection in sour wells, Protection of Cr-based tubulars, Corrosion of organic acids, Microbial corrosion, and Removal of corrosion products</td>
</tr>
<tr>
<td>8-9</td>
<td>Acids Used in Carbonate Formations</td>
<td>Emulsified Acid, In Situ Gelled Acids, Viscoelastic Surfactant-Based Acids, Cement Bond Logs, and Foamed Acids</td>
</tr>
<tr>
<td>10-11</td>
<td>Acids Used in Sandstone Formations</td>
<td>Mud acids, Retarded HF-based acids, and Chelating Agents</td>
</tr>
<tr>
<td>12-13</td>
<td>Water Shut-Off Using Chemical Means</td>
<td>Sodium Silicate Gels, Inorganic scale as a means for water shut-off, Gelling Polymers using metal cross-linkers, and Relative permeability modifiers</td>
</tr>
<tr>
<td>14-15</td>
<td>Recent Advances in Cementing and Drilling Fluids</td>
<td>Light weight cements, Flexible cements, Acid Resistant cement, New weight material for drilling fluids, Emulsifiers used in oil-based mud, and techniques to remove various filter cakes</td>
</tr>
</tbody>
</table>

Other Pertinent Course Information
Americans with Disabilities Act (ADA)

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Academic Integrity

For additional information please visit: http://www.tamu.edu/aggiehonor

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Texas A&M University
Department of Petroleum Engineering
Proposed Course Syllabus

Number and Name of Course: PETE 644: CO₂ Capture and Uses: Sequestration, Enhanced Oil Recovery (EOR)

Hours: Theory 3 Practice 0 Total 3 Credits 3

Prerequisites: graduate classification

Course Description

CO₂ capture and storage (CCS) involves the injection and containment of CO₂ in geological structures such as depleted oil and gas reservoirs, onshore and offshore saline aquifers located deep in the earth’s crust, salt caverns or un-minable coalbeds. This is an approach that can be used to improve the energy production from existing fossil fuel operations (Enhanced Oil and Gas Recovery) as well as a means of reducing greenhouse gas emissions. This course will provide a scientific and technological foundation designed to provide answers to questions important to those interested in investigating the potential of CCS to enhance energy production and reduce greenhouse gases as well as to policy makers.

To this effect, the course will provide the students with the methodology and the tools to evaluate and quantify the potential, uncertainties and risks involved in CCS or EOR. Safety, economic, and environmental and legal aspects will also be covered.

And interdisciplinary team will participate in the development of this course to address these different aspects of the CCS problem.

Text Materials

Selected publications from the literature; industry and governmental reports; handouts.
"Carbon Dioxide Capture and Storage", Intergovernmental Panel on Climate Change, Cambridge University Press, 2005 (available online)

Course Topics and Outline (Total 40 Class Hours)

The order of some modules may be rearranged

Module 1.
The Need for CO₂ Sequestration & CO₂ Properties
Background Introduction – Market for the Knowledge in this Course (Global Warming, Improved Oil Recovery, Economics).
Physical and chemical properties of fluids: pure CO₂ and mixtures
Fundamentals of Phase Separation Processes
Thermodynamic and Transport Properties.

Module 2.
Separation Aspects, Design Calculations, Efficiencies
Overview of Power Plants, Gasification and IGCC.
Membrane Separation.

**Module 3.**
**Geological Screening, Reservoir Characterization**
Storage Options for CO₂: Types of geological storage projects.

**Module 4/5**
**Production and Injection Aspects, Transportation, Compression, Well design**
CO₂ compression and transportation to storage reservoir.
Transportation/Recycling.

**Module 6**
**Geologic Storage Modeling: Tools and Techniques**
EOR Uses, Material Balance Approaches

**Module 7**
**Economics, Regulations**

**Grading Policy**

Reading Assignments and HW ...........................................................(30%)

Final Project (individual) (35% final report, 35% final presentation).........................(70%)

Total.............................................................................................................(100%)

**Course Coordinator**

**Dr. Maria A. Barrufet**
Office: 407C Richardson Bldg
Tel: (979) 845-0314
e-mail: maria.barrufet@pe.tamu.edu

Miscellaneous

Laboratory Requirements: Yes: ________ No: x ________
Equipment Required: None

Americans with Disabilities Act (ADA) Policy Statement:
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Academic Integrity Statement and Policy:
For many years Aggies have followed a Code of Honor, which is stated in this very simple verse:

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

The Aggie Code of Honor is an effort to unify the aims of all Texas A&M men and women toward a high code of ethics and personal dignity. For most, living under this code will be no problem, as it asks nothing of a person that is beyond reason. It only calls for honesty and integrity, characteristics that Aggies have always exemplified.

The Aggie Code of Honor functions as a symbol to all Aggies, promoting understanding and loyalty to truth and confidence in each other.

For additional information visit http://www.tamu.edu/aggiehonor/

Helpful Links:
Academic Calendar http://admissions.tamu.edu/registrar/general/calendar.aspx
Final Exam Schedule http://admissions.tamu.edu/registrar/general/finalschedule.aspx
On-Line Catalog http://www.tamu.edu/admissions/catalogs/
Student Rules http://student-rules.tamu.edu/
Religious Observances http://dof.tamu.edu/faculty/policies/religiousobservance.php
Course title and number  PETE 645: Upscaling of Geologic Models for Flow Simulation
Term (e.g., Fall 200X)  Fall 2012
Meeting times and location  2:20 – 5:10 p.m., Thursday, RICH 208

Course Description and Prerequisites

This is an advanced reservoir engineering course which covers the upscaling of 3D geologic models for reservoir flow simulation. It is based on published papers and supplemented by research topics. The students will be expected to develop upscaling solvers as part of this course. Graduate classification. Attendance will be limited to a maximum of 15 students.

Learning Outcomes or Course Objectives

The objectives of the course are for students to:
1. Acquire an in-depth understanding of current approaches to upscaling of geologic models for flow simulation.
2. Develop tools that are more advanced than those available within any commercial application

Instructor Information

Name  Prof. Michael J. King
Telephone number  (979) 845-1488
Email address  mike.king@tamu.edu
Office hours  W, 3:00-5:30 p.m.
Office location  401E Richardson Building

Textbook and/or Resource Material

Additional readings will be supplied with the course.

Grading Policies

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentations &amp; Class Participation</td>
<td>(10%)</td>
</tr>
<tr>
<td>Homework</td>
<td>(15%)</td>
</tr>
<tr>
<td>Major Project</td>
<td>(25%)</td>
</tr>
<tr>
<td>Mid-Term Exam</td>
<td>(25%)</td>
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<tr>
<td>Final Exam</td>
<td>(25%)</td>
</tr>
<tr>
<td>Total</td>
<td>(100%)</td>
</tr>
</tbody>
</table>

Grading Scale

- A ...........................................90-100%
- B ...........................................80-89%
- C ...........................................70-79%
- D ...........................................60-69%
- F ...........................................0-59%
Course Topics, Calendar of Activities, Major Assignment Dates
Details may be Varied During the Semester

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to geologic modeling and flow simulation</td>
</tr>
<tr>
<td></td>
<td>- Uses of geologic models and reservoir simulators</td>
</tr>
<tr>
<td></td>
<td>- Understanding the overall iterative workflow</td>
</tr>
<tr>
<td></td>
<td>- Streamline flow visualization</td>
</tr>
<tr>
<td>2</td>
<td>Basic multi-phase flow equations in porous media</td>
</tr>
<tr>
<td></td>
<td>- Black oil equations</td>
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<tr>
<td></td>
<td>- Derivation of the pressure equation</td>
</tr>
<tr>
<td></td>
<td>- Neumann and Dirichlet boundary conditions</td>
</tr>
<tr>
<td>3-4</td>
<td>Finite difference/Finite element discretizations/flow visualization and solver projects</td>
</tr>
<tr>
<td></td>
<td>- Five point discretization (2D)</td>
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<tr>
<td></td>
<td>- Peaceman Well Indices (2D)</td>
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<tr>
<td></td>
<td>- K/O/U methods (2D)</td>
</tr>
<tr>
<td></td>
<td>- Development of student projects</td>
</tr>
<tr>
<td>5-6</td>
<td>Upscaling of Flow</td>
</tr>
<tr>
<td></td>
<td>- Permeability Upscaling</td>
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<td></td>
<td>- Analytic Approaches</td>
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<td></td>
<td>- Flow Based Upscaling</td>
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<td>- Local / Non-Local / Global Upscaling</td>
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<td></td>
<td>- Transmissibility Upscaling</td>
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<td></td>
<td>- Near Well Upscaling</td>
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<td></td>
<td>- Diagnostics</td>
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<td></td>
<td>- Recommendations</td>
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<tr>
<td>7-8</td>
<td>Upscaling of Static Properties</td>
</tr>
<tr>
<td></td>
<td>- Stratigraphic Grids</td>
</tr>
<tr>
<td></td>
<td>- Bulk Rock Volume / Net Rock Volume / Pore Volume / Fluid Volumes</td>
</tr>
<tr>
<td></td>
<td>- Facies</td>
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<tr>
<td></td>
<td>- Well Blocking</td>
</tr>
<tr>
<td></td>
<td>- Diagnostics</td>
</tr>
<tr>
<td></td>
<td>- Recommendations</td>
</tr>
<tr>
<td>9-10</td>
<td>Grid Upscaling</td>
</tr>
<tr>
<td></td>
<td>- Corner Point Grids</td>
</tr>
<tr>
<td></td>
<td>- Multiscale Grid Mapping</td>
</tr>
<tr>
<td></td>
<td>- Error Analysis &amp; Simulation Grid Design</td>
</tr>
<tr>
<td></td>
<td>- Faults and Fault Blocks</td>
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<tr>
<td></td>
<td>- Unstructured Grids</td>
</tr>
<tr>
<td></td>
<td>- Recommendations</td>
</tr>
<tr>
<td>11-12</td>
<td>Multiphase Flow</td>
</tr>
<tr>
<td></td>
<td>- Relative Permeability End-points and Capillary Pressure</td>
</tr>
<tr>
<td></td>
<td>- Steady State Upscaling</td>
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<tr>
<td></td>
<td>- Pseudoization and Unsteady State Upscaling</td>
</tr>
<tr>
<td></td>
<td>- Multiscale Simulation</td>
</tr>
<tr>
<td></td>
<td>- Recommendations</td>
</tr>
<tr>
<td>13-15</td>
<td>Class Projects</td>
</tr>
<tr>
<td></td>
<td>- Student Presentations</td>
</tr>
</tbody>
</table>
Other Pertinent Course Information

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Academic Integrity
For additional information please visit: http://www.tamu.edu/aggiehonor

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Course title and number  PETE 646 - Reservoir Characterization and Forecasting
Term (e.g., Fall 200X)  Fall 2010
Meeting times and location  T, 5:15-7:45 P.M., RICH 302

Course Description and Prerequisites

Emphasis on geostatistical estimation/simulation and advanced mathematical inversion methods, integration of three important aspects of reservoir development and management: i) stochastic reservoir description, ii) reservoir model updating; and iii) model-predictive reservoir control and management.

Prerequisites: Graduate classification; basic familiarity with linear algebra, probability, statistics, differential and integral calculus and general reservoir engineering.

Learning Outcomes or Course Objectives

The objectives of the course are for students to:

1. Cover statistical modeling of spatial uncertainty used for stochastic reservoir identification.
2. Combine various data sources and geological knowledge with conceptual models of geological continuity to construct predictive reservoir models for future reservoir development and management.
3. Overview a broad range of topics including spatial variability modeling, two-point and multi-point geostatistics, reservoir parameterization, production data integration and model-predictive reservoir control and management.

Instructor Information

Name
Telephone number
Email address
Office hours  Wednesday, 4:00-6:00 P.M. or by appointment
Office location

Textbook and/or Resource Material

There is no required textbook for this course, however, a few main texts are listed as suggested references. Course handouts and reading material will be posted to the class shared folder on the PE server and the web for distance learning. In addition to lectures, there will be a few computational lab sessions for hands-on introduction to required geostatistical software packages, i.e. SGeMS, ECLIPSE, MATLAB and other software packages that are needed in this course.

Grading Policies

Homework ................................................................. (30%)
Midterm Exam ............................................................ (30%)
Class Project ............................................................. (40%)
Total ........................................................................... (100%)
Grading Scale

A………………………………………………………………………………………………………..90-100%
B……………………………………………………………………………………………………….80-89%
C……………………………………………………………………………………………………….70-79%
D……………………………………………………………………………………………………….60-69%
F………………………………………………………………………………………………………..0-59%

Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction and Review Material</td>
</tr>
<tr>
<td>2</td>
<td>Geostatistical Reservoir Description and Modeling; Review of Spatial Statistics, Linear Algebra</td>
</tr>
<tr>
<td>3</td>
<td>Linear Estimation and Kriging</td>
</tr>
<tr>
<td>4</td>
<td>Stochastic Simulation</td>
</tr>
<tr>
<td>5-6</td>
<td>Beyond Two-Point Geostatistics</td>
</tr>
<tr>
<td>7-9</td>
<td>Reservoir Model Updating Through Production Data Integration</td>
</tr>
<tr>
<td>10-11</td>
<td>Parameterization and Model Reduction</td>
</tr>
<tr>
<td>12</td>
<td>Reservoir Control and Management; Model Predictive Control (MPC)</td>
</tr>
<tr>
<td>13</td>
<td>MPC Formulations and Solutions</td>
</tr>
<tr>
<td>14</td>
<td>Project Presentations</td>
</tr>
<tr>
<td>15</td>
<td>Final Project Report</td>
</tr>
</tbody>
</table>

Other Pertinent Course Information

Americans with Disabilities Act (ADA)

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Academic Integrity

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“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Petroleum Engineering 648
Pressure Transient Testing
Syllabus and Administrative Procedures
Spring 2010

Catalog Course Description:
Diffusivity equation and solutions for slightly compressible liquids; dimensionless variables; type
curves; applications of solutions to buildup, drawdown, multi-rate, interference, pulse and
deliverability tests; extensions to multiphase flow; analysis of hydraulically fractured wells.
Prerequisites: PETE 324 and 620; approval of graduate advisor.

Instructor: Prof. Christine Ehlig-Economides
Office: RICH 710
Office Hours: By appointment
Phone: 979 458-0797
Email: caee@tamu.edu

Textbook:
John Lee, John B. Rollins, and John P. Spivey: Pressure Transient Testing, SPE Textbook Series

Recommended Reading:
• C.S. Matthews and D.G. Russell: Pressure Buildup and Flow Tests in Wells, SPE
  Monograph Vol. 1, 1967
• R. Earlougher, Jr.: Advances in Well Test Analysis, SPE Monograph Vol. 5, 1977
• Energy Resources Conservation Board, Theory and Practice of the Testing of Gas Wells,
  Alberta, Canada, 1975.
• SPE Reprint Series, No. 9: Pressure Analysis Methods, 1967.
• SPE Reprint Series, No. 57: Pressure Transient Testing, V. I and II, 2004
• Abramowitz, M, and Steegan, I.A.: Handbook of Mathematical Functions, National
• Economides, M.J., Hill, A.D., and Ehlig-Economides, C.A.: Petroleum Production

Course Requirements:
  Homework/Teamwork  30%
  Exams  40%
  Team Project  30%

Typically homework is assigned every week. Students will present homework solutions in class
according to a random selection. Failure to be prepared to present when asked will reduce
homework grade by 10%. Students must indicate ahead of time when they have a reason to miss
class. Collaboration on homework is encouraged, and the class will be divided into teams. DL
students must post their homework solutions by the homework due date.

There will be 2 in-class exams. Each DL student will need to return the completed exam by5 pm
on the following Monday according to instructions provided with the exam.
Each team will do a final project. The project will be assigned at the time of the first exam. Each team will present the project during the week following the last lecture class. The final project report is due the week after the project presentations.

Course Objectives:
1. Experience how well test models are derived and computed
2. Experience how to simulate pressure transient test behavior and how to design well tests*
3. Experience how to process, quality check, diagnose, and analyze pressure transient data
4. Understand the behavior of well and reservoir response patterns observed in well tests, what well and reservoir parameters can be quantified, and how to quantify them from pressure transient data*

*Using commercial software

Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topic [Lecture Number]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction - Overview of the Course [1,2]</td>
</tr>
<tr>
<td>2</td>
<td>Modeling – Diffusivity Equation Derivation, Solutions; PTT Ch. 1, App. A, B [3]*</td>
</tr>
<tr>
<td>3</td>
<td>Modeling – Solution Implementation, Type Curves; PTT Ch. 4, App. F [4]*</td>
</tr>
<tr>
<td>4</td>
<td>Superposition; PTT Ch. 1-2, App. E [5]</td>
</tr>
<tr>
<td>5</td>
<td>Wellbore Storage and Skin; Index PTT wellbore storage, skin [6]</td>
</tr>
<tr>
<td>6</td>
<td>Flow Regimes; PTT App. G [7]</td>
</tr>
<tr>
<td>7</td>
<td>Test Design; PTT Ch. 8-11, App. K [8]</td>
</tr>
<tr>
<td>8</td>
<td>Exam I - In class</td>
</tr>
<tr>
<td>9</td>
<td>Spring Break</td>
</tr>
<tr>
<td>10</td>
<td>Gas Well Testing, Multiphase Testing; PTT Ch. 3, App. C [9,10]</td>
</tr>
<tr>
<td></td>
<td>Naturally Fractured Reservoirs; PTT Ch. 7 [11]</td>
</tr>
<tr>
<td>11</td>
<td>Partial Penetration/Limited Entry; PTT Ch. 2 Sec. 2.4.5 [12]</td>
</tr>
<tr>
<td>12</td>
<td>Hydraulically Fractured Wells; PTT Ch. 6 [15]</td>
</tr>
<tr>
<td>13</td>
<td>Reservoir Limits [13]</td>
</tr>
<tr>
<td>14</td>
<td>Horizontal Wells; PTT Ch. 12 [14]</td>
</tr>
<tr>
<td>15</td>
<td>Final Exam - In class</td>
</tr>
</tbody>
</table>

Americans with Disabilities Act (ADA) Policy Statement

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the University Curriculum Committee by the Department of Student Life. The policy statement was forwarded to the Faculty Senate for information.

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Academic Integrity Statement

“An Aggie does not lie, cheat, or steal or tolerate those who do.”
Definitions of Academic Misconduct [http://www.tamu.edu/aggiehonor/academisinconduct.htm]

1. **Cheating**
   Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices or materials in any academic exercise.

2. **Fabrication**
   Making up data or results, and recording or reporting them; submitting fabricated documents.

3. **Falsification**
   Manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.

4. **Multiple Submissions**
   Submitting substantial portions of the same work (including oral reports) for credit more than once without authorization from the instructor of the class for which the student submits the work.

5. **Plagiarism**
   The appropriation of another person's ideas, processes, results, or words without giving appropriate credit.

6. **Complicity**
   Intentionally or knowingly helping, or attempting to help, another to commit an act of academic dishonesty.

Course title and number: 650 Advanced Drilling Engineering
Term: Spring 2013
Meeting times and location: Monday, Room 319L and Online from 11:30 a.m. to 2:40 p.m.

Course Description and Prerequisites

Catalog Description: Underbalanced drilling, Horizontal, Extended Reach, Multi-Lateral Drilling, Fishing Operations, Geothermal Drilling, High Pressure High Temperature Drilling.

Prerequisites(s): PETE 405 or equivalent basic drilling engineering

Learning Outcomes or Course Objectives

Provides students with an introduction to advanced drilling topics such as well control, underbalanced drilling, modern drilling technologies, designer wells, geothermal well drilling and fishing operations. Additionally this course offers the opportunity to learn about team work and distance learning communication

Topics Covered:
1. Introduction to class, review of important topics of previous courses
2. Advanced drilling technology Topics: Managed pressure drilling, dual gradient drilling, special well control issues.
4. Drilling Problems: stuck pipe situations, fishing operation
5. Underbalanced Drilling- Introduction to UBD, UBD techniques, benefits of UBD equipment, selecting an appropriate candidate, and UBD well engineering.
6. Advanced drilling technologies – casing drilling, HPHT, Introduction to Horizontal/Extended Reach/and Multilateral Drilling Operations
7. Non-conventional drilling methods and equipment including environmental aspects of drilling activities
8. Geothermal Drilling
Special topics (some of them covered by industry experts)

Instructor Information

Name: Catalin Teodoriu
Telephone number: N/A
Email address: catalin.teodoriu@pe.tamu.edu
Office hours: Online available most of the time
Office location: Web

Textbook and/or Resource Material

None at this time
Grading Policies

Method of Evaluation:
- Final examination: 60%
- Design Project: 40%
- Total: 100%

Americans with Disabilities Act (ADA)
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Academic Integrity
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“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Course title and number  PETE 656: Advanced Numerical Methods for Reservoir Simulation
Term (e.g., Fall 200X)  Spring 2014
Meeting times and location  W → 09:10am -12:20pm
                                  RICH 208

Course Description and Prerequisites
This class covers the numerical simulation of multiphase flow in heterogeneous porous media with emphasis on advanced techniques based on numerical methods for discretization of partial differential equations combined with state-of-the-art linear and nonlinear solvers and well modeling; The students are expected to develop a numerical reservoir simulator and benchmark against commercial-of-the-shelf software;
Prerequisites: Basic Reservoir Simulation or equivalent class; Linear Algebra and Matrix Computations of equivalent class; Advanced Calculus or equivalent class; Programming experience.
Graduate classification. Attendance will be limited to a maximum of 25 students.

Learning Outcomes or Course Objectives
The objectives of the course are for students to:
1. Develop an in-depth understanding of current approaches to building models of flow in porous media and their numerical simulation.

Instructor Information
Name  Dr. Eduardo Gildin
Telephone number  (979) 862-4578
Email address  eduardo.gildin@pe.tamu.edu
Office hours  W @ 1:30pm (or by appointment – send e-mail!)
Office location  401J Richardson Building

Textbook and/or Resource Material
The main source of material for the course will be a series of notes and slides handed out to the students. Complementary textbooks are:
Understanding and Implementing the Finite Element Method by Mark S. Gockenbach, SIAM, 2006.
Theory and Practice of Finite Elements by Alexandre Ern and Jean-Luc Guermond, Springer, 2004
Finite Volume Methods for Hyperbolic Problems, Randall LeVeque, 2004

Grading Policies
Homework ................................................................. (30%)
Mid-Term Exam .......................................................... (30%)
Final Project ............................................................ (40%)
Total ................................................................. (100%)
Grading Scale

A……………………………………………………………………………………………………..90-100%
B………………………………………………………………………………………………………80-89%
C………………………………………………………………………………………………………70-79%
D………………………………………………………………………………………………………60-69%
F………………………………………………………………………………………………………..0-59%

Course Topics, Calendar of Activities

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1    | Introduction to reservoir simulation and partial differential equations  
      |   ○ Research issues  
      |   ○ Understanding the overall iterative workflow  
      |   ○ Introduction to partial differential equations  
      |   ○ PDE’s solution methods |
| 2-3  | Porous Media Flow and Transport Equation  
      |   ○ Single-phase flow  
      |   ○ Two-phase flow  
      |   ○ Rock and Fluid Properties  
      |   ○ Multiphase flow  
      |   ○ Black-oil model |
| 4-9  | Numerical Methods - Discretization  
      |   ○ Finite difference methods  
      |   ○ Mid Term Project: Single/Two-Phase Finite Differences  
      |   ○ Standard Finite Element Methods  
      |   ○ Control Volume Methods – TPFA and MPFA  
      |   ○ Mixed Finite Element Methods  
      |   ○ IMPES and AIM  
      |   ○ Convergence, Accuracy, and Stability |
| 10-12| Solution to Linear and Nonlinear Systems  
      |   ○ Gaussian Elimination  
      |   ○ CG  
      |   ○ GMRES  
      |   ○ Preconditioning  
      |   ○ Multigrid Methods |
| 13-14| Special Topics  
      |   ○ Linear Hyperbolic equations  
      |   ○ Conservation laws - Finite Volume Methods  
      |   ○ Upwind and Godunov's Methods  
      |   ○ High resolution methods (TVD)  
      |   ○ Convergence, Accuracy, and Stability  
      |   ○ Model Reduction  
      |   ○ Gridding  
      |   ○ Other requests |
| 15   | Class Projects  
      |   ○ Final Project: Two-Phase Finite Volume/Elements  
      |   ○ Simulator Results |
Course Projects

Mid Term Project   usually assigned at the 7th-8th week
Representation of a single and two-phase (oil-water) partial differential equations;
Finite Differences discretization;
Well Modeling;
Direct Solvers (Gaussian Elimination)
Project Report: mathematical formulation and discretization; codes and results

Final Project   usually assigned at the 13th. week
Representation of a two-phase (oil-water or oil-gas) partial differential equations;
Finite Volumes/Elements discretization;
Well Modeling;
Iterative Solvers (GMRES, CG, BiCGSTAB)
Project Report: mathematical formulation; codes and results; comparison of iterative and direct solvers

Other Pertinent Course Information
Since general reservoir simulation concepts will be discussed with no emphasis on specific areas, all engineering majors are welcome to attend the class. Also, mathematics and applied mathematics students are well suited to attend this course, although there will be no specific emphasis on the numerical algorithms and theorems proofs. The prerequisites for the class are the following: Basic Reservoir Simulation or equivalent class; Linear Algebra and Matrix Computations of equivalent class; Advanced Calculus or equivalent class; Programming experience. Although Matlab will be emphasized in this class, any other language that the student is familiar with (Fortran, C, C++, etc) will be fine as well.

Americans with Disabilities Act (ADA)
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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity
For additional information please visit: http://www.tamu.edu/aggiehonor

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Course title and number: PETE 657: High-Performance Computing Applied to Earth Sciences and Petroleum Engineering Applications
Term (e.g., Fall 200X): Fall 2013
Meeting times and location: M, 11:30 a.m. - 2:40 p.m., RICH 912B

Course Description and Prerequisites
Covers the numerical simulation of problems in Earth sciences and petroleum engineering using high performance computing (HPC). Students are expected to develop a parallel reservoir simulator as part of this course.
Graduate classification. Attendance will be limited to a maximum of 15 students.

Learning Outcomes or Course Objectives
The objectives of the course are for students to:
1. Develop an in-depth understanding of current approaches to building and simulating complex models of flow in porous media and Earth sciences using high performance computing.
2. Bridge the gap between reservoir modeling and simulation, high performance computing and parallel implementations, having a solid theoretical background in parallel architectures (software and hardware) and practical solutions to real world large-scale problems faced by scientists and petroleum engineers. It is based on textbooks related to parallel programming and numerical methods for partial differential equations and on published papers, and supplemented by research topics.

Instructor Information
Name: Dr. Vivek Sarin, Dr. Eduardo Gildin and Dr. George Moridis
Telephone number: (979) 862-4578
Email address: eduardo.gildin@pe.tamu.edu
Office hours: TBD
Office location: 401J Richardson Building

Textbook and/or Resource Material
The main source of material for the course will be a series of notes and slides handed out to the students. Complementary textbooks are:
Introduction to Parallel Computing, 2nd ed., by A. Grama, A. Gupta, G. Karypis, and V. Kumar, Addison-Wesley
An Introduction to Parallel Algorithms, by Joseph JaJa, Addison-Wesley Publishing Company
Numerical Analysis, Burden and Faires, 2005
Matrix Computations, Golub and Van Loan, 1996
Understanding and Implementing the Finite Element Method by Mark S. Gockenbach, SIAM, 2006.
Theory and Practice of Finite Elements by Alexandre Ern and Jean-Luc Guermond, Springer, 2004
Finite Volume Methods for Hyperbolic Problems, Randall LeVeque, 2004
Petroleum Reservoir Simulation, by Khalid Aziz and A. Settari, 1979
**Grading Policies**

Homework ......................................................................................................................... (50%)
Final Project Presentation ............................................................................................... (15%)
Final Project Report ........................................................................................................ (35%)
Total ................................................................................................................................... (100%)

**Grading Scale**

A ........................................................................................................................................... 90-100%
B ........................................................................................................................................... 80-89%
C ........................................................................................................................................... 70-79%
D ........................................................................................................................................... 60-69%
F ............................................................................................................................................... 0-59%

**Course Topics, Calendar of Activities, Major Assignment Dates**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART I</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Overview of high performance computing</td>
</tr>
<tr>
<td>2</td>
<td>Parallel algorithm design</td>
</tr>
<tr>
<td>3</td>
<td>Parallel architectures</td>
</tr>
<tr>
<td>4</td>
<td>Basic algorithms</td>
</tr>
<tr>
<td>5</td>
<td>Parallel programming with MPI</td>
</tr>
<tr>
<td>6</td>
<td>Performance analysis</td>
</tr>
<tr>
<td>7</td>
<td>Solution to Linear and Nonlinear Systems</td>
</tr>
<tr>
<td>PART II</td>
<td></td>
</tr>
<tr>
<td>8 - 9</td>
<td>Overview of reservoir simulation</td>
</tr>
<tr>
<td>10 - 12</td>
<td>Parallel reservoir simulation code development</td>
</tr>
<tr>
<td>13 - 14</td>
<td>Application of Parallel Computing (commercial-of-the-shelf software)</td>
</tr>
<tr>
<td>PART III</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Final Presentations</td>
</tr>
</tbody>
</table>

**Other Pertinent Course Information**

Since general reservoir simulation concepts will be discussed with no emphasis on specific areas, all engineering and computer science majors are welcome to attend the class. Also, mathematics and applied mathematics students are well suited to attend this course, although there will be no specific emphasis on the numerical algorithms and theorems proofs. The prerequisites for the class are the following: *Basic Reservoir Simulation or equivalent class; Linear Algebra and Matrix Computations of equivalent class; Advanced Calculus or equivalent class; Programming experience. Although Matlab will be emphasized in this class, any other language that the student is familiar with (Fortran, C, C++, etc) will be fine as well.*
Americans with Disabilities Act (ADA)

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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity

For additional information please visit: http://www.tamu.edu/aggiehonor

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Drilling Engineering

(3-0). Credit 3

Course Description: Introduction to drilling systems; wellbore hydraulics; casing design; identification and solution of drilling problems; well cementing; drilling of directional and horizontal wells; wellbore surveying; abnormal pore pressure; fracture gradients; well control; offshore drilling; underbalanced drilling.

Prerequisites: Approval of instructor


Selected Technical Papers.

Suggested Basis for Grading:
- Homework: 25%
- Quiz A: 25%
- Quiz B: 25%
- Project: 25%

Grading Policy:
- >89.5 = A
- 79.5 – 89.4999 = B
- 69.5 – 79.4555 = C
- 59.5 – 69.4999 = C
- <59.5 = F

Topics:
- The drilling rig, drilling fluids, rig selection, drilling problems: 4
- Wellbore hydraulics and design of circulation system: 3
- Casing design procedures; collapse, burst, tension: 3
- Abnormal pressure prediction, fracture gradients: 5
- Kick tolerance and well control: 4
- Primary and secondary cementing, cement plugs: 4
- Directional drilling, wellbore surveying techniques: 3
- Horizontal drilling, coiled tubing drilling: 4
Offshore drilling, including dual-gradient drilling 6
Underbalanced drilling 6

Quizzes: (3 hours)
Total: 45 hours

Computer usage: Required for homework and project

**Academic Integrity Statement:** “An Aggie does not lie, cheat, or steal or tolerate those who do.” Collaboration on examinations and assignments is forbidden except when specifically authorized. Students violating this policy may be removed from the class roster and given a F in the course or other penalties as outlined in the Texas A&M University Student Rules. See [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor)

**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 Department of Student Life, Services for Students with Disabilities, in Cain Hall or call 845-1637.
PETE 662  Production Engineering  
Instructor:  Dr. Ding Zhu  
Office:  RICH 501L  
Office Hours:  Th 3:30-3:40  
Phone:  4584522  
e-mail:  dingzhu@tamu.edu

COURSE SYLLABUS

Description:  This course is a survey course in petroleum production engineering, beginning with the material in the textbook, and going beyond this level with the aid of other material from the literature. I will review basic undergraduate production engineering material at a fairly rapid pace. The primary topics that will be covered include reservoir inflow, skin effects and formation damage, well completion performance, multiphase flow in pipes, and artificial lift. A course outline is given below.

Objectives:  
- Learn engineering methods to evaluate and optimize oil and gas well performance.

Text:  Petroleum Production Systems, by M. J. Economides, A. D. Hill, C. Ehlig-Economides and Ding Zhu + supplemental papers

Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>topic</th>
<th>chapter(s) covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>introduction to production engineering; review of reservoir inflow</td>
<td>1-5</td>
</tr>
<tr>
<td>4-5</td>
<td>skin effects and formation damage, well completion performance</td>
<td>6</td>
</tr>
<tr>
<td>6-8</td>
<td>flow in pipes and well deliverability</td>
<td>7-10</td>
</tr>
<tr>
<td>9-10</td>
<td>artificial lift</td>
<td>11-12</td>
</tr>
<tr>
<td>11-14</td>
<td>well stimulation (acidizing and fracturing)</td>
<td>13-18</td>
</tr>
<tr>
<td>15</td>
<td>class project presentations; review</td>
<td></td>
</tr>
</tbody>
</table>
COURSE POLICIES

1. Attendance: Class attendance is important. I will supplement the material in the textbook with additional published and unpublished material, some of which may be presented only during class time. I encourage you to attend class regularly.

2. Examinations: Examinations are not optional. Make-up of major examinations will be given only for university excused absences.

3. Grading:
   - Homework & Projects 40%
   - Mid-term Exam 30%
   - Final Exam 30%

   The course grade will be based on homework assignments, a mid-term exam, and a final examination. The final exam will be given at the regularly scheduled time. One or more of the homework assignments will be projects of larger scope than the usual homework assignments; these projects will comprise half of the homework grade.

4. Academic Integrity Statement: "An Aggie does not lie, cheat, or steal or tolerate those who do." Collaboration on examinations and assignments is forbidden except when specifically authorized. Students violating this policy may be removed from the class roster and given a F in the course or other penalties as outlined in the Texas A&M University Student Rules. See http://www.tamu.edu/aggiehonor

5. 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 Department of Student Life, Services for Students with Disabilities, in Cain Hall or call 845-1637.
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Objectives:
- Learn engineering methods to evaluate and optimize oil and gas well performance.

Text: *Petroleum Production Systems*, 2\textsuperscript{nd} edition by M. J. Economides, A. D. Hill, C. Ehlig-Economides, and D. Zhu + supplemental papers

Course Schedule

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<td>skin effects and formation damage, well completion performance</td>
<td>5</td>
</tr>
<tr>
<td>6-9</td>
<td>well stimulation, acidizing and hydraulic fracturing</td>
<td>13-18</td>
</tr>
<tr>
<td>10-13</td>
<td>multiphase flow in pipes</td>
<td>7, 10</td>
</tr>
<tr>
<td>14</td>
<td>artificial lift</td>
<td>19-20</td>
</tr>
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**COURSE POLICIES**

1. **Attendance:** Class attendance is important. I will supplement the material in the textbook with a considerable amount of additional published and unpublished material, some of which may be presented only during class time. I encourage you to attend class regularly.

2. **Examinations:** Examinations are not optional. Make-up of major examinations will be given only for university excused absences.

3. **GRADING:**
   - Projects: 30%
   - Mid-term Exam: 30%
   - Final Exam: 40%

   The course grade will be based on projects, a mid-term exam, and a final examination. The final exam will be given at the regularly scheduled time (Friday, May 7, 8-10 am for in-class students). There will be homework sets assigned approximately weekly. These will not be graded, but solutions will be posted a week after the homework is assigned so that you can check your work. I strongly encourage you to work the homework assignments to be prepared for the exams.

4. **Late Work Policy:** You are required to complete your work during the time allotted. For project assignments, they are to be handed in at the start of class for in-class students and to be electronically submitted by the assigned date and time for Distance Learning students. Projects turned in after the due time but less than one day late will receive a 50% penalty; projects submitted more than a day late will receive a grade of 0. For Distance Learning students, if you have a short-term work assignment that will prevent you from submitting an assignment on time, you must petition well ahead of time to get an exception to this rule. In general, you are given sufficient time to complete all assignments, so this circumstance should be rare.

5. **Academic Integrity Statement:** “An Aggie does not lie, cheat, or steal or tolerate those who do.” 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 other penalties as outlined in the Texas A&M University Student Rules. See [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor). I am providing a separate document describing what I define as cheating and what I will do about it.

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Petroleum Engineering 663  
Formation Evaluation and the Analysis of Reservoir Performance  
Tentative Syllabus and Administrative Procedures  
Summer 2013

Course Instructor/Supervisor: (Class Meetings: T, Th 12:00-1:50 p.m., RICH 313)

<table>
<thead>
<tr>
<th>(Petroleum Geoscience)</th>
<th>(Formation Evaluation)</th>
<th>(Analysis of Reservoir Performance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Walter Ayers</td>
<td>Dr. David Schechter</td>
<td>Dr. Tom Blasingame</td>
</tr>
<tr>
<td>Tel. (979) 458-0721</td>
<td>Tel. (979) 845-2275</td>
<td>Tel. (979) 845-2292</td>
</tr>
<tr>
<td>Office: Rm. 401M RICH</td>
<td>Office: Rm. 401Q RICH</td>
<td>Office: 821A RICH</td>
</tr>
<tr>
<td>Office Hours: tba/appointment</td>
<td>Office Hours: tba/appointment</td>
<td>Office Hours: tba/appointment</td>
</tr>
<tr>
<td>e-mail: <a href="mailto:walt.ayers@pe.tamu.edu">walt.ayers@pe.tamu.edu</a></td>
<td>e-mail: <a href="mailto:david.schechter@pe.tamu.edu">david.schechter@pe.tamu.edu</a></td>
<td>e-mail: <a href="mailto:t-blasingame@pe.tamu.edu">t-blasingame@pe.tamu.edu</a></td>
</tr>
</tbody>
</table>

TA: Raul Gonzales; e-mail: raul.gonzalez@pe.tamu.edu

Text Materials:
- Petroleum Geosciences (Ayers)
  - Morton-Thompson and Woods, eds.: Development Geology Manual, 1992, AAPG, Tulsa (Optional; available at AAPG (800-364-2274) or www.aapg.org);
- All assigned reading will be provided as .pdf files
- Formation Evaluation (Schechter) (.pdf version will be provided)
  - Openhole Log Analysis and Formation Evaluation, Halliburton (.pdf version will be provided)
- Analysis of Reservoir Performance (Blasingame)
  - Most (if not all) assigned reading will be provided as .pdf files.

Reference Materials: Will be handed out or placed on an accessible website as needed.
1. Reference notes.
2. Journal articles.
3. Presentation materials.

Basis for Grade: (components given as percentage of total grade average)

| Geology: Hwk/Quizzes/Projects (13.3333 percent), Exam 1 (20 percent) | 33.33 percent |
| Formation Evaluation: Hwk/Quizzes/Projects (13.3333 percent), Exam 2 (20 percent) | 33.33 percent |
| Reservoir Performance: Hwk/Quizzes/Projects (33.3333 percent) | 33.33 percent |

Total = 100.00 percent

Grade Cutoffs: (Percentages)
A: < 90  B: 89.99 to 80  C: 79.99 to 70  D: 69.99 to 60  F: < 59.99

Policies and Procedures:
1. Students are expected to attend class every session.
2. Always bring your textbook, notes, homework problems, and calculator to class.
3. Homework and other assignments will be given at the lecture session. All work shall be done in an acceptable engineering manner; work done shall be as complete as possible. Assignments are due as stated. Late assignments will receive a grade of zero.
4. Policy on Grading
   a. It shall be the general policy for this class that homework and exams shall 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.
5. Policy on Regrading
   a. Only in very rare cases will exams 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 which, while correct, cannot be followed, will be considered incorrect — and will not be considered for a grade change.
   c. Grades assigned to homework problems will not be considered for regrading.
   d. If regrading is necessary, the student is to submit a letter to the instructor explaining the situation that requires consideration for regrading and the material to be regraded must be attached to this letter. The letter and attached material must be received within one week from the date returned.
Policies and Procedures: (Continued)

6. 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. If a student comes to class after homework has been turned in and after class has begun, the student's homework will be considered late and given a grade of zero. 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.

7. Each student should review the University Regulations concerning attendance, grades, and scholastic dishonesty. In particular, anyone caught cheating on an examination or collaborating on an assignment where collaboration is not specifically allowed will be removed from the class roster and given an F (failure grade) in the course. Specifically, you are NOT AUTHORIZED to collaborate any individual assignment, exam, quiz, etc.; this includes discussions, sharing materials, etc. You are expressly FORBIDDEN from such actions on any and all assignments. You are only permitted to collaborate on assignments if the instructor specifically authorizes such collaborations, and then for only for the assignment where such collaboration is authorized. Failure to abide by this guideline will invoke an F (failure grade) in the course or on the assignment, at the discretion of the instructor, based on the severity of the infraction.

Course Description

The purpose of this course is to provide the student with a working knowledge of the current methodologies used in geological description/analysis, formation evaluation (the analysis/interpretation of well log data), and the analysis of well performance data (the design/analysis/interpretation of well test and production data). The overall course objective is to provide the student with the ability to assess field performance and to optimize hydrocarbon recovery by analyzing/interpreting/integrating geologic, well log, and well performance data.

Course Objectives

The student should be able to perform the tasks given below for each course module.

**Course Module 1: Petroleum Geosciences (Ayers)**

- Identify components of a petroleum system; name and describe the organic sources of hydrocarbons.
- Describe the processes of thermal maturation, primary and secondary migration, and hydrocarbon trapping; name and describe 2 types of self-sourcing reservoirs.
- Describe the origin and significance of structural features, including folds, fractures, and traps; describe unconformities; describe the methods and tools used for structural evaluations and modeling.
- Explain and give examples of in-situ stress effects on absolute permeability and permeability anisotropy.
- Characterize clastic and carbonate reservoirs by describing the geometry, orientation, and continuity of sedimentary facies and their relations to flow units and reservoir quality.
- List examples of diagenetic effects on clastic and carbonate reservoir quality.
- Describe porosity-permeability relations in clastic and carbonate reservoirs; give examples of scalar effects on permeability determination.
- Explain/describe stratigraphic traps.
- Describe the methods, tools, and workflow for developing a reservoir model.

**Course Module 2: Formation Evaluation (Schechter)**

- Describe and explain the following operational aspects of open-hole logging:
  - Logging operations surface and downhole equipment.
  - Describe logging operation procedures.
  - Explain how to read a basic open-hole log from a standard triple combo tool.
  - Calculate volumetric estimate of original fluids in place
- Explain and apply the principles of operation and interpretation of the following logs:
  - Gamma Ray: demonstrate calculation of Vshale, determine gamma ray response for common rocks
  - Spontaneous Potential: demonstrate calculation of Vshale and formation water resistivity
  - Sonic: calculate sonic porosity, describe Rwa technique

Appendix I - Page 138
Petroleum Engineering 663
*Formation Evaluation and the Analysis of Reservoir Performance*

**Syllabus (Continued)**
**Summer 2013**

- Neutron Density: describe gas and shale effect, determine neutron density crossplot porosity, determine lithology from neutron-density cross plot
- Resistivity: describe resistivity measurements in terms of invasion diameter
- Apply the following techniques to calculate water saturation:
  - Archie’s law
  - Pickett plot
  - Hingle plot
  - Shaly sand analysis

**Course Module 3: Analysis of Reservoir Performance (Blasingame)**

- **Pressure Transient Analysis (PTA)**
  - Derive and apply the analysis and interpretation methodologies for pressure drawdown and pressure buildup tests — for liquid, gas, and multiphase flow systems (i.e., "conventional" plots and type curve analysis)
  - Apply dimensionless solutions ("type curves") and field variable solutions ("specialized plots") for the following cases:
    - Unfractured and fractured wells in infinite and finite-acting, homogeneous and dual porosity reservoirs.
    - Variable-rate convolution (specialized plots).
    - Pseudopressure and pseudotime concepts for the analysis of well test data for dry gas reservoir systems.

- **Production Analysis (PA)**
  - (Time-Rate) Perform "Decline Curve Analysis" (DCA) to estimate reserves and predict future performance.
  - (Time-Rate-Pressure) Perform "model-based analysis" to estimate reservoir properties and reserves.
  - Demonstrate the capability to integrate, analyze, and interpret well test and production data to characterize a reservoir in terms of reservoir properties and performance potential (field study project).

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 04 T</td>
<td>(Geol) Introduction; petrol. systems; source rocks; therm. mature; HC migration</td>
<td>WebCT, pdf</td>
</tr>
<tr>
<td>06 Th</td>
<td>(Geol) Geologic time and principles, trapping mech; seals; struct. styles and features</td>
<td>WebCT, pdf</td>
</tr>
<tr>
<td>11 T</td>
<td>(Geol) Structural assessment and traps; folds and fractures; unconformities</td>
<td>WebCT, pdf</td>
</tr>
<tr>
<td>13 Th</td>
<td>(Geol) Geophysical methods in petroleum evaluation</td>
<td>WebCT, pdf</td>
</tr>
<tr>
<td>18 T</td>
<td>(Geol) Res. Characterization; stratigraphic analysis; clastic and carbonate deposition systems; stratigraphic traps</td>
<td>WebCT, pdf</td>
</tr>
<tr>
<td>20 Th</td>
<td>(Geol) Reservoir properties and diagenesis</td>
<td>WebCT, pdf</td>
</tr>
<tr>
<td>June 21 T</td>
<td>(Online examination assigned; due date 11 p.m., 25 June)</td>
<td></td>
</tr>
</tbody>
</table>

**Module 3: Analysis of Reservoir Performance (Blasingame)**

| July 04 Th | HOLIDAY                                                                 |                          |
| July 09 T  | (FrmEvl) Resistivity methods I — Principles                              | Halliburton Ch. 11-14    |
| 11 T       | (FrmEvl) Resistivity methods II — Advanced measurements; Crossplots II — Saturation-related functions | Halliburton Ch. 21,24,25 |
| 16 T       | (FrmEvl) Shaly-sand evaluation — Causes and effects; interpretation      | Hall. Ch. 27; Handout     |
| July 16 T  | *Formation Evaluation Examination ?*                                     |                          |

There is no comprehensive final examination for this course — the timeslot for the final examination will be used as the final due date for assignments related to the Analysis of Reservoir Performance (Module 3).
Americans with Disabilities Act (ADA) Statement:
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Aggie Honor Code: (http://www.tamu.edu/aggiehonor/)
"An Aggie does not lie, cheat or steal, or tolerate those who do."

Definitions of Academic Misconduct:
1. CHEATING: Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices or materials in any academic exercise.
2. FABRICATION: Making up data or results, and recording or reporting them; submitting fabricated documents.
3. FALSIFICATION: Manipulating research materials, equipment or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
4. MULTIPLE SUBMISSION: Submitting substantial portions of the same work (including oral reports) for credit more than once without authorization from the instructor of the class for which the student submits the work.
5. PLAGIARISM: The appropriation of another person's ideas, processes, results, or words without giving appropriate credit.
6. COMPLICITY: Intentionally or knowingly helping, or attempting to help, another to commit an act of academic dishonesty.
7. ABUSE AND MISUSE OF ACCESS AND UNAUTHORIZED ACCESS: Students may not abuse or misuse computer access or gain unauthorized access to information in any academic exercise. See Student Rule 22: http://student-rules.tamu.edu/
8. VIOLATION OF DEPARTMENTAL OR COLLEGE RULES: Students may not violate any announced departmental or college rule relating to academic matters.
9. UNIVERSITY RULES ON RESEARCH: Students involved in conducting research and/or scholarly activities at Texas A&M University must also adhere to standards set forth in University Rule 15.99.03.M1 - Responsible Conduct in Research and Scholarship. For additional information please see: http://rules.tamu.edu/urules/100/159903m1.htm.

Plagiarism Statement:
The materials used in this course are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which 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 is 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 regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty."
Instructor: George Voneiff
Contact Information:
  Voneiff: Phone 979-574-7179; Email george.voneiff@pe.tamu.edu
Office: No office on campus, I have a business office at 2425 Earl Rudder Freeway, College Station
Office Hours: By appointment, Fridays before class is best
Description: Deterministic evaluation techniques for oil & gas properties focusing on economic analyses, reserves classifications and decision making.
Objectives:
  • Compute net present value, rate of return and payout for a cash flow stream.
  • Construct and run a decline curve history matching and forecasting model.
  • Construct and run a before-tax economic model utilizing a production forecast
  • Use economic outputs to make a business decision.
  • Assign reserves to a deterministic reserves classification system.
  • Present the recommendations, conclusions and results of an economic evaluation in a well-organized report.
  • Apply depreciation schedules to an after-tax economic evaluation.
Text: You must purchase the text books BEFORE classes start. The Mian book can be purchased on-line and takes a few days to arrive. Not having the textbook is not an acceptable excuse for incomplete or late homework.
  Cronquist, C., Estimation and Classification of Reserves of Crude Oil, Natural Gas, and Condensate, SPE (2001) (available from SPE)
Class Schedule: Friday 1:50 – 5:25 PM, 313 Richardson
Prerequisite: While there is no prerequisite, it is assumed you have a basic understanding of reservoir engineering principles and are proficient with MS Excel. If you are lacking either of these traits, then you may need to supplement this class with reservoir engineering study and/or spreadsheet training.
Basis for grade:
  Homework and class discussion................................. 20%
  Mid Project .......................................................... 30%
  Final Project ......................................................... 50%
Notes:

1. Homework is due at the start of class and should be turned in electronically. Word documents, Excel spreadsheets and .PDF files are acceptable. Late homework will receive a grade of zero.
2. Mid-Term and Final Projects will be turned in electronically. In-Class students will also turn in a printed version of those projects.
3. Class discussions will include reading assignments and homework. Please come to class prepared to discuss the assigned topics for the day.
4. Assignments and other course materials will be posted on Vista. You will need to establish a Vista account for this class and monitor the web site regularly.

Vista Account

Because course information will be posted on Vista regularly, I ask that you please monitor at least once a day. To set up your Vista account for this course, please do the following:

Go to elearning.tamu.edu.
Find the link to Vista Logon. Click the link.
If you are a PETE Graduate Student, use your NetID (Neo ID and password) to logon.
If you are a PETE Certificate Student, use your assigned ID and password.
Click on the course name.

This should be all you need. If you think you can't get there from here, please contact Mary Lu Epps or Ted Jones in the 407 office suite for help.

Academic Integrity Syllabus Statement

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It is further recommended that instructors print the following on assignments and examinations:

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Signature of student

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PETE 665

Petroleum Reservoir Engineering

Syllabus and Administrative Procedures

Instructors:
Dr. Maria A. Barrufet – Modules 1 and 2
Dr. Michael King – Module 3
Teaching Assistant: Ernesto Valbuena

Petroleum Engineering Department
Texas A&M University

e-mail: maria.barrufet@pe.tamu.edu

Contact Information: 979.845.0314
Office: Rooms 407C Richardson Building
Office Hours: MWF 4:00 – 5:00 PM or by appointment

Course Description:

665. Petroleum Reservoir Engineering (3-0). Credit 3
Reservoir description techniques using petrophysical and fluid properties; engineering methods to
determine fluids in place, identify production-drive mechanisms, and forecast reservoir performance;
implementation of pressure-maintenance schemes and secondary recovery. Prerequisite: Approval of
instructor or graduate classification

ACCESSING AND DOWNLOADING MATERIALS FROM LIBRARY (live tutorial for on-campus and distance-
learning students)

Well Test Analysis – The Use of Advanced Interpretation Models, by Dominique Bourdet,
Elsevier.

Additional resources will be available from e-learning (power points, selected articles, web links) and from
the instructors.

ADMINISTRATIVE PROCEDURES

Class Schedule
MWF 3:00 PM to 3:50 PM – Room 208 RICH

Grading:
Your final grade in PETE 665 is based on your individual performance and your participation as a team member. All students are expected to participate either in class or using the e-campus discussion board. Your participation is important to the success of the course as much of the learning will occur in collaboration with your classmates. The homework assignments and threaded discussions are ways you can demonstrate you have mastered lesson objectives, and will help prepare you for the exams. All assignments should be completed on schedule. Homework will be discussed in class and there will be three exams as indicated in the table below.

The following is the grading policy

**GRADING SUMMARY PETE 665**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Percentage</th>
<th>Rules</th>
<th>Tentative Exam Dates (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Discussions, Homework &amp; Participation</td>
<td>10 %</td>
<td>Individual and Team</td>
<td></td>
</tr>
<tr>
<td>Exam #1 (Module 1 – Barrufet)</td>
<td>30 %</td>
<td>Take home/timed/open-book</td>
<td>February 14th - 17th</td>
</tr>
<tr>
<td>Exam #2 (Module 2 – Barrufet)</td>
<td>30 %</td>
<td>Take home/timed/open-book</td>
<td>March 28th - 31st</td>
</tr>
<tr>
<td>Exam #3 (Module 3 – King)</td>
<td>30 %</td>
<td>TBD</td>
<td>May 2th – May 6th</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Grade Due</td>
<td></td>
<td></td>
<td>May 12th (HARD DATE)</td>
</tr>
</tbody>
</table>

**GUIDELINES FOR PAPER REVIEW**

It should take no more than one page to summarize a typical paper. Some papers may require more; use your own judgment. Learn to be concise and to state briefly the essential ideas communicated.

**USUAL ORGANIZATION OF A REVIEW** (adapted from Dr. John Lee)

- Authors, title. Use the SPE standard reference style. (You can find it in the SPE Guide to Publications, which is on the web at http://www.spe.org)
- Problem. Briefly, describe the problem the authors are trying to solve.
- Solution. Describe the solution the authors propose. Did they propose a specific method to recover additional oil, do they discuss data required, limitations, do they analyze performance? What is it?
- Value. Describe the value of the authors’ solution to the petroleum industry.
- Conclusions. Describe the conclusions the authors reached as a result of their analysis
- Approach. Describe what the authors did to validate their proposed solution.
- Limitations. List the limitations of the work. Is it applicable to only a certain type of reservoir or field?
- Application. How would you apply the knowledge provided in this paper?
- Critique. What questions did the authors leave unanswered? What could the authors have done to make the paper better?
OBJECTIVES FOR REVIEWING PAPERS IN THIS CLASS

- To learn how to learn from papers (harder than textbooks, but more important in the long run)
- To learn how to identify the really important ideas in papers
- To learn how to summarize ideas concisely
- To learn how engineers with vastly different points of view think and how they approach problems and their solutions

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_________________________
Signature of Student

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Course Content

Module 1: Fundamentals of Reservoir Fluid and Rock Properties (13 lectures – Maria Barrufet) (January 13th to February 12th) – Note: No class on Monday January 20th - Martin Luther King

Course Overview
Fundamentals of Reservoir Fluid Behavior. Phase Behavior Fundamentals From: Pressure/Temperature and Pressure/Composition Diagrams
Classification of Reservoir Fluids
Reservoir Engineering Gas Properties: Laboratory Analysis and Correlations
Reservoir Engineering Oil Properties: Laboratory Analysis and Correlations and Correlations
Vapor-Liquid Equilibrium Models and Phase Equilibria Calculations (Separator, Boundaries, Gas Injection, Reservoir)
Determination of Reservoir Fluid Composition from Recombination Tests
Fundamentals of Rock Properties: Porosity. Fluid Saturations and Wettability
Permeability – Electrical Conductivity of Fluid Saturated Rocks
Capillary Pressure – Core Analysis
Relative Permeability – Interfacial Tension

Module 2: Oil and Gas Recovery Mechanisms and the Generalized Material Balance Equation (14 Lectures – Maria Barrufet) (February 14th to March 24th) Note: Spring Break March 10th to 14th)

Rock and Fluid Expansion.
Material Balance Gas Solution Gas-Drive, Gas-Cap Drive
Material Balance Oil Reservoirs
Modified Material Balance Volatile Oil and Gas Condensates
Generalized Material Balance Equation
Oil and Gas Performance – Forecasting
Water Drive and Classification of Aquifers. Aquifer Models: Schilthuis Hurst and Van Everdingen, Fetkovitch.
Fractional Flow Theory.
Buckley-Leverett One Dimensional Displacement
Displacement under Segregated Flow Conditions. Oil Recovery Calculations
Enhanced Oil Recovery Methods. Screening Criteria
Gas Injection and Thermal Recovery

Module 3: Fundamentals of Fluid Flow in Porous Media (14 Lectures– Mike King) (March 26th to April 28th) Note: No class on Friday April 18th

Well Performance Equations.
Well Inflow Equations for Stabilized Flow Conditions
Constant Terminal Rate Solution of the Radial Diffusivity Equation and Applications to Oilwell Testing
Pressure Buildup Analysis Techniques
Multi-Rate Drawdown Testing
Real Gas Flow: Gas Well Testing
Analysis and Modeling of Production Data.
Instructors: George Voneiff
Contact Information: Phone 979-574-7179; Email george.voneiff@pe.tamu.edu
Office: 2425 Earl Rudder Freeway, College Station, Texas
Office Hours: By appointment, Fridays before class is best.

Description: Probabilistic evaluation techniques for oil & gas properties, including reservoir descriptions, economic analyses, reserves classifications and decision making.

Objectives:
- Compute and graph mean, median, standard deviation, percentile and distribution type for a population and use those parameters in a probabilistic analysis
- Construct and solve expected value trees for oil & gas applications
- Load and run the @Risk Excel add-in module
- Construct and run Monte Carlo simulations for oil & gas applications
- Use probabilistic outputs to make a business decision
- Assign reserves to a probabilistic reserves classification system
- Present the recommendations, conclusions and results of a probabilistic evaluation in a well-organized report

ISBN: 978-1-59370-209-0 (v. 2)

Prerequisite: PETE 664 (no exceptions), you should be proficient with MS Excel and you will need to load and use Palisade’s @Risk Excel add-in. You will be responsible for purchasing your own copy, student versions are available. You will also need two spreadsheets you built in PETE 664, a decline curve production forecasting spreadsheet and a 40-yr monthly before-tax petroleum economics spreadsheet.

Class Schedule: Fridays, 2-5 PM, Richardson Bldg.

Basis for grade:

- Homework and class discussion .................................................. 20%
- Mid-Term Project ......................................................................... 30%
- Final Project ................................................................................ 50%
Notes:

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2. Mid-Term and Final Projects will be turned in electronically. In-Class students will also turn in a printed version of those projects.
3. Class discussions will include reading assignments and homework. Please come to class prepared to discuss the assigned topics for the day.
4. Assignments and other course materials will be posted on Vista. You will need to establish a Vista account for this class and monitor the web site regularly.

**eCampus Account**

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Go to [http://ecampus.tamu.edu](http://ecampus.tamu.edu).
If you have problems, click on the link “Check Browser Support” on the entry page to eCampus.
Find the link to **Log In.** Click the link.
Use your **NetID** (Neo ID and password) to logon.
Click on the **course name**.

This should be all you need. If you think you can't get there from here, please contact Mary Lu Epps ([marylu.epps@pe.tamu.edu](mailto:marylu.epps@pe.tamu.edu)) or Ted Seidel ([ted.seidel@pe.tamu.edu](mailto:ted.seidel@pe.tamu.edu)) in the 407 office suite for help.

**Academic Integrity Syllabus Statement**

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

If I catch you cheating, usually by turning in work that is not your own and represented as your work, you will receive a zero on that assignment, and probably fail the class, and I will file an Aggie Honor Code Violation.

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________________________________

Signature of student

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Catalog Description: The purpose of this course is to prepare the student to able to achieve differentiating drilling performance in the most complex wells. This includes training in the underlying physics of each type of performance limiter and real time and engineering practices to address the limitation. Students are also taught performance management workflows and change models required to effectively change the way organizations conduct the work, which is an essential element in achieving higher performance.

Prerequisites(s): Graduate status, and PETE 405 or PETE 661

Instructor: Fred E. Dupriest, Professor of Engineering Practices, P.E., Petroleum Engineering Department, RICH 501L, (979) 862-1138, fred.dupriest@pe.tamu.edu, or other Petroleum Engineering Department faculty as appropriate.

Topics Covered:
1. Drilling industry business models, performance management processes, and change management concepts
2. Principles of bit mechanics and engineering and operational practices to redesign rock cutting dysfunction to increase performance
3. Principles of borehole instability and engineering design and real time practices to redesign borehole quality to achieve higher drilling performance
4. Integrity testing and advanced test evaluation practices
5. Physics-based practices for planning and executing wells to manage borehole integrity and treat lost returns
6. Hole cleaning practices to maximize drilling performance and footage per day
7. Borehole quality and drilling practices to eliminate stuck pipe

Class/Laboratory Schedule: T/R 11:10am - 12:25pm

Textbook and/or Resource Material: The main source of material for the course will be presentation slides and other reference material posted on a shared class site.

Method of Evaluation:
- Exams (2) 50%
- Final 25%
- Homework 10%
- Group Project 15%
- Total 100%

Grading Scale
- A…………………………………………………………………………..90-100% Excellent
- B……………………………………………………………………………80-89% Good
- C……………………………………………………………………………70-79% Acceptable
- D……………………………………………………………………………60-69% Unsatisfactory
- F……………………………………………………………………………..0-59% Failure
Contributions to Professional Component:

<table>
<thead>
<tr>
<th>Math and Science</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum Engineering</td>
<td>Physics-based drilling engineering design of operational practices to extend performance limitations.</td>
</tr>
<tr>
<td>General Education</td>
<td>Organizational behavior. Performance management workflows. Deployment of new practices in knowledge-based industries</td>
</tr>
</tbody>
</table>

Course Learning Outcomes and Relationship to Program Outcomes:

<table>
<thead>
<tr>
<th>Course Learning Outcome: At the end of the course, students will be able to...</th>
<th>Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to implement a performance management workflow for identifying and redesigning drilling performance limitations</td>
<td>1,3,6,12,16</td>
</tr>
<tr>
<td>Ability to design and implement a change model to enhance the deployment of new physics-based practices in operations</td>
<td>1,3,6,12,16</td>
</tr>
<tr>
<td>Ability to identify the form of bit dysfunction that is limiting performance and apply physics-based, real time, operational and post drill engineering practices to extend the limitation</td>
<td>1,3,5,11,15,16</td>
</tr>
<tr>
<td>Ability to apply physics-based operational and engineering redesign practices to extend cuttings transport and hole cleaning performance limitations</td>
<td>1,3,5,11,15,16</td>
</tr>
<tr>
<td>Ability to apply physics-based operational and engineering practices to extend performance limitations related to borehole instability</td>
<td>1,3,5,11,15,16</td>
</tr>
<tr>
<td>Ability to interpret complex leadoff tests, with particular emphasis on channel identification and repair practices</td>
<td>1,5,11,16</td>
</tr>
<tr>
<td>Ability to apply physics-based operational and engineering redesign practices to prevent or mitigate lost circulation</td>
<td>1,3,5,11,15,16</td>
</tr>
<tr>
<td>Ability to apply practices that eliminate differential sticking and other causes of stuck pipe</td>
<td>1,3,5,11,16</td>
</tr>
</tbody>
</table>

Related Program Outcomes:

<table>
<thead>
<tr>
<th>No.</th>
<th>PETE graduates must have...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An ability to apply knowledge of mathematics, science, and engineering.</td>
</tr>
<tr>
<td>3</td>
<td>An ability to design a system, component, or process to meet desired needs.</td>
</tr>
<tr>
<td>5</td>
<td>An ability to identify, formulate, and solve engineering problems.</td>
</tr>
<tr>
<td>6</td>
<td>An understanding of professional and ethical responsibility.</td>
</tr>
<tr>
<td>11</td>
<td>An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
</tr>
<tr>
<td>12</td>
<td>An ability to recognize and take into account the constraints offered by political and social systems, including environmental considerations, in problem definition and solution.</td>
</tr>
<tr>
<td>15</td>
<td>Competency in math thru diff eqs, probability and statistics, fluid mechanics, strength of materials, and thermodynamics.</td>
</tr>
<tr>
<td>16</td>
<td>Competency in design and analysis of well systems and procedures for drilling and completing wells.</td>
</tr>
</tbody>
</table>

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Class Norms
- Arrive on time
- No personal email
- No personal internet
- Use of electronic media to facilitate classroom learning encouraged

Academic Integrity
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Course title and number  PETE 689 – Transport Processes in Subsea Systems
Term (e.g., Fall 200X)  TBA
Meeting times and location  TBA

Course Description and Prerequisites
Production and distribution of hydrocarbons from petroleum reservoirs require a knowledge of flow of multiphase fluids and heat transfer between the fluids and their surroundings. This is especially true for off-shore operations where significant cooling of fluids could lead to solids deposition. Frequent shut-in and startup of wells also demand an understanding of transient transport processes relevant to such systems. This course teaches the fundamentals of multiphase flow and heat transfer in petroleum production systems with emphasis on subsea systems. Basic background in undergraduate fluid mechanics and heat transfer are pre-requisites.

Learning Outcomes or Course Objectives
This course exposes students to various elements of fluid and heat flows that occur in wells and pipelines. The fundamentals of multiphase flow are explained in terms of single-phase flow mechanics and configuration of the phases. The principles of heat transfer is applied to estimate fluid temperature and heat loss during petroleum production in subsea systems. The goal is to teach simple modeling approaches. Field examples are used to reinforce understanding of the models. Problem solving with spreadsheets is done in the class to indicate engineering usage of the models.

Instructor Information
Name  Dr. Rashid Hasan
Telephone number  (979) 847-8564
Email address  rashid.hasan@pe.tamu.edu
Office hours  TBA
Office location  RICH 501 E

Textbook and/or Resource Material
- Other Materials: SPE technical papers in related subjects.

Grading Policies
Homework  15%
First Midterm  35%
Final Exam/Project  50%
## Course Topics, Calendar of Activities, Major Assignment Dates

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Introduction:</td>
</tr>
<tr>
<td></td>
<td>- Overview of Single-phase flow principles.</td>
</tr>
<tr>
<td></td>
<td>- Basic multiphase flow concepts and definitions.</td>
</tr>
<tr>
<td></td>
<td>- Petroleum production systems – wells, risers, and flow lines.</td>
</tr>
<tr>
<td></td>
<td>- Method of analysis.</td>
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<td></td>
<td>- Homogeneous and Separated flow models.</td>
</tr>
<tr>
<td>3-5</td>
<td>Mechanistic models of multiphase flow in vertical wells:</td>
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<tr>
<td></td>
<td>- Flow pattern delineation</td>
</tr>
<tr>
<td></td>
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<td>Multiphase flow in Inclined nonconventional systems:</td>
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<td>- Energy balance for wellbore fluid, fluid temperature in single conduits.</td>
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### Other Pertinent Course Information

#### Americans with Disabilities Act (ADA)

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 Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).

#### Academic Integrity

For additional information please visit: [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu)

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”
Appendix J – Seminar Schedule
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<td>Davis L. Ford</td>
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<td>Hydraulic Fracking of Tight Oil and Gas</td>
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<td>Michael King</td>
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<td>Robust Streamline Tracing Using Inter-cell Fluxes in Locally Refined and Unstructured Grids</td>
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<td>Zoya Heidari</td>
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<td>Estimation of dynamic petrophysical properties of water-bearing sands invaded with oil-base mud from multi-physics borehole geophysical measurements</td>
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<td>Vivek Sarin</td>
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<td>Iterative Methods for Large, Sparse Linear</td>
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<td>Development of a Statistically Based Design Methodology for Acid Fracturing</td>
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<td>Jim Jennings</td>
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<td>An introduction to permeability averaging and the effects of scale on the permeability of heterogeneous rocks</td>
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<td>Catalin Teodoriu</td>
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<td>Testing of Oil Country Tubular Goods for oil and Gas Applications: Pushing to the Limits</td>
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<td>Unconventional Gas Reservoir Models for Unconventional Gas Reservoirs</td>
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<td>Battelle Energy Technology</td>
<td>Modeling and Analysis of Pressure Changes during Saline Aquifer Geo-sequestration</td>
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<td>Robert Bishop</td>
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<td>Precision Kalman Filtering Employing Smart Sensors Coupled with MEMS IMUs</td>
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<td>Ding Zhu</td>
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<td>The Role of Flow Control Devices in Optimizing Horizontal Well Performance</td>
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<td>Aida Rahim</td>
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<td>Quinn Passey</td>
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<td>My Source Rock is Now My Reservoir - Geologic and Petrophysical Characterization of Shale-Gas Reservoirs</td>
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<td>Temperature &amp; Noise Logging for Reservoir Flow Evaluation</td>
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<td>IODP: Installing Ultra-Deep Observatories</td>
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<td>A Systemic Approach to Modeling Wellbore Heat Transfer</td>
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<td>Depth of Investigation and Depletion Behavior in Unconventional Reservoirs Using Fast Marching Methods</td>
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<td>Identifying Flow Compartments, Calculating Saturations and Estimating Permeability</td>
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<td>Practical Seismic Petrophysics: The Effective Use of Log Data for Seismic Analysis</td>
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<td>Challenges and Needs for Process Safety in the New Millennium</td>
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<td>G. Paul Willhite</td>
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<td>Predicting Carbon Dioxide Miscible Flooding-Laboratory to Field Test - Hall Gurney Field, Kansas</td>
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<td>Clastic Sedimentary Petrology: The Control of Provenance on Reservoir Quality and Rock Properties of Clastic Sediments</td>
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<td>Big Data, Large Volumes and Advanced Analytics in Exploration and Production</td>
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<td>Prudhoe Bay Field: Technology Development Overview</td>
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<td>Asking the right research questions: In-Situ Combustion</td>
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<td>Andrew Wojtanowicz</td>
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<td>Gas Migration at Wells – A Problem with Few Solutions</td>
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<td>Multi-scale Discussions on Gas Storage and Transport in Organic-rich Shale</td>
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<td>Bobby Poe</td>
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<td>Improved Reservoir and Well Performance Evaluation Using Production Decline Analyses</td>
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<td>Jerry Jensen</td>
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<td>Field-Based Connectivity Predictions without Simulation</td>
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<td>Mark Proett</td>
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<td>The Pace of Technology is Accelerating for WL and LWD Formation Testers</td>
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<td>Stephen A. Holditch</td>
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<td>Shale Gas Development – Doing it Right</td>
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<td>Industrial automation methods and equipment and their potential application to the well construction industry</td>
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<td>Jesus Salazar</td>
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Appendix L – Google Scholar Citations
Harold Vance Department of Petroleum Engineering, Texas A&M University (Top 100 citations)

Citation indices

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<td>Fuel 82 (9), 1075-1084</td>
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**Research Funding**

The success of any research program starts with writing quality research proposals. In 2013, we had 62 proposals submitted by our faculty totaling $23.3 million. Of these, 28 were awarded in 2013 totaling $6.9 million. 14 proposals were declined. The other 20 proposals totaling $12.2 million were still under review with many of them submitted to Federal agencies. We received 78 Research Awards in 2013 that totaled $9.3 million. This number is higher than the $6.9 million awarded based on proposals submitted through TEES, because there is considerable funding that we receive without any proposal being written. For example, all of the Crisman Institute funding comes in each year without a formal proposal being written. The sponsors came from both Government and Industry partners. The success of our Graduate Program is directly tied to our research success. Research funding goes to support our Graduate students through research assistantships and tuition support.

**Proposals submitted in 2013**

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<th>Proposal Title</th>
<th>Sponsor</th>
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<tr>
<td>The Center for Computational and Applied Unconventional Hydrocarbon Technology</td>
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<td>Operation and Maintenance of the Ocean Energy Safety Institute (OESI)</td>
<td>US Dept. of the Interior</td>
<td>Mannan, M. Sam-CH</td>
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<td>Novel Artificial Lift Methods to Increase Reserves in Unconventional Reservoirs</td>
<td>Research Partnership to Secure Energy for America</td>
<td>Zhu, Ding -PE</td>
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<td>Improved Flow Assurance through Better Monitoring Using Transport Processes Modeling and Interpretation of Temperature/Pressure Data in Ultra-Deepwater Wells</td>
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<td>Optimal Local-Global Multiscale Model Reduction in Heterogeneous Porous Media Flow Modeling</td>
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<td>Mapping In-Situ Combustion Dynamics Tomography and Microseismic Simultaneously</td>
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<td>Estimation of gas-water and gas-oil relative permeability in carbonate rocks from 3D MicroCT-scan images</td>
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<td>Development and Field Validation of Multiscale Fast Marching Methods to the</td>
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<td>Characterization and Optimization of Unconventional Oil and Gas Reservoirs</td>
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<td>Analysis of Feasibility and Potential Environmental Impact of Hydraulic Fracturing in Shale Gas Reservoirs</td>
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<td>Applications of Ionic Oil in the Oil Industry</td>
<td>Alchemy Ionics, Limited</td>
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<td>Numerical and laboratory investigations for maximization of production from tight/shale oil reservoirs: From fundamental studies to technology development and evaluation</td>
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<td>Joint Industry Project (JIP): Liquid Loading in the Operation of Gas Fields: Mechanisms, Prediction and Reservoir Response, Second Phase</td>
<td>Shell Exploration &amp; Production Company</td>
<td>Valko, Peter P.-PE</td>
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<td>Time-Lapse Seismic Monitoring and Performance Assessment of CO2 Sequestration in Hydrocarbon Reservoirs</td>
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<td>Development of Continuing Education and Academic Curricula Program for Addressing the Potential Hazards Associated with Emerging Technologies</td>
<td>DHHS-NIH-National Institute of Environmental Health Science</td>
<td>Mannan, M. Sam-CH Barrufet, Maria A.-PE Gupta, Anju -LS Mentzer, Ray A-CH Pasman, Hermanus J-CH Rogers, William J.-CH Valko, Peter P.-PE</td>
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<td>Centrifugal Pressure - Vibrating Membrane Reverse Osmosis Desalination and Fracking Waste Water Recovery</td>
<td>Qatar National Research Fund</td>
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<td>Application of Nanoparticle Imaging in Quantifying Diagenesis Effects of Propping Agent</td>
<td>Saint-Gobain Technical Fabrics</td>
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<td>Fluid-Proppant Interactions</td>
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<td>TEEM NACME – Transforming Engineering Education for underrepresented Minorities through a partnership with NACME</td>
<td>National Action Council for Minorities in Engineering</td>
<td>Taylor, Valerie -CS Froyd, Jeff E-EA Lagoudas, Magdalini Z.-EP Reed, Teri K-PE</td>
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<td>Pilot Scale Testing for GRC Modules</td>
<td>GE Power Systems</td>
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<td>New Applications of GLDA in the Oilfield</td>
<td>Akzo Nobel Functional Chemicals, LLC</td>
<td>Nasr-El-Din, Hisham A-PE</td>
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<td>Prediction and Soap-Stick Remediation of Liquid Loading in Gas Wells</td>
<td>Pennsylvania State University</td>
<td>Hasan, Rashid -PE</td>
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<td>Request For Proposal To Examine Potential For Collecting Flammable Gas Mixture In Riser During EC-Drill Operations</td>
<td>AGR Subsea A/S</td>
<td>Schubert, Jerome J.-PE</td>
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<td>Collaborative Research: Novel Recursive Evolutionary Algorithms For Parameters Estimation in Kinematic Laplacian Equation Of Fluid Systems</td>
<td>National Science Foundation</td>
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<td>Screening &amp; Predicting Modeling Tools for CO2 Huff-n-Puff Operations</td>
<td>Battelle Memorial Institute</td>
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<td>Modeling Performance of Fractured Horizontal Well in Shale Gas Reservoirs</td>
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<td>Atomistic Modeling of Complex Nanofluids at Water-Oil Interfaces and Numerical Prediction of Interfacial Tension</td>
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<td>Acid Treatments for Sandstone Reservoirs</td>
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<td>Stochastic Geomechanics for Shale Gas Computing – Phase II</td>
<td>Servicios y Suministros en Informatica S.A. de C.V.</td>
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<td>Work Stability of Frac Fluid Materials under Elevated Temperature and Pressure</td>
<td>BP America Production Company</td>
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<td>Investigation of Interaction of Frac Fluids with Wolfcamp Rock Samples</td>
<td>Pioneer Natural Resources</td>
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<td>Effect of Carbonate Rock Type and Fluid Rheology on Matrix Acidizing Treatments</td>
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<td>Simulation of UCR using Meshless Method: Accurate Performance Predictions of Dual Porosity Reservoirs with Transverse Fractures</td>
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<td>Enhanced Recovery of Hydraulic Fracturing Water</td>
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Declined: 17-JUL-13

Awarded: 12-NOV-12

Total: 23,291,910.30
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<td>Randy Energy Services, Inc.</td>
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<td>QA - Enhancing Gas-Condensate Well Productivity by Wettability Alteration -- Cycle 3</td>
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<td>QA - Development of Methods for Improving Displacement Efficiency and Reducing Water Production in Carbonate Reservoirs-- Cycle 3</td>
<td>Qatar National Research Fund</td>
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Appendix M – Page 8
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