Petroleum Geoscience
Fall 2015     CH EN 6163
3.0 Units, required for M.S. in Petroleum Engineering
Tuesdays and Thursdays, 9:10 to 10:30 a.m.

Instructor:
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Research Professor, Energy & Geoscience Institute, University of Utah
Tel. 801-587-9070; Email: rsorkhabi@egi.utah.edu

Course Rationale and Learning Outcomes

The formation, distribution and preservation or destruction of oil and natural gas resources are governed by geologic histories of basins and the sedimentary, geochemical and tectonic processes operating in them. Oil industry is an expensive and risky enterprise. Petroleum geoscience is a crucial tool for finding and developing hydrocarbon resources and for reducing the business risks. Petroleum geoscience, in its varied aspects, is thus a key component to the modern methods of exploration, development and production in the petroleum industry. This Petroleum Geoscience course aims to provide students with a knowledge-base (1) to understand the fundamental terms, principles, and tools of petroleum geoscience in order to communicate with other professional and comprehend petroleum geoscience reports and discussions, (2) to understand how various disciplines and methods of geoscience are integrated to characterize and evaluate hydrocarbon basins and prospects, and (3) to better benefit from other courses offered in this M.S. Petroleum Engineering Program.
Reading Materials for the Course

Course Materials and Main Textbooks:

Each week of the course will focus on a certain topic and will consist of two lectures. Lectures will be recorded and uploaded online by the University; lecture materials will be uploaded to the Canvas site by the Instructor at the end of each week. Class participation and reviewing the lectures and powerpoint files are necessary for success in the course.

The following textbooks will be used for the course, but none replaces the Instructor’s lectures and powerpoint files (these should be considered as most necessary for the course).


[A basic textbook on petroleum geology; will be throughout the course]


[An advanced textbook on petroleum geology with emphasis on some new topics and developments; will be throughout the course]


[This is a pictorial, basic book on geology. It is most relevant for Module I of the course. Read it with fun; it will help better understand Module I and geology in general.]

Why Geology Matters, Doug Macdoughall (University of California Press, 2011)

[Like the previous book, this is most relevant for Module I of the course: It will enrich your knowledge of geology.

This book is a must read for online/long-distance students in lieu of their class attendance. After reading the book, the student should write 20 interesting points (about a paragraph each with page number) that he/she learned from the book. The report will contribute toward the long-distance students’ attendance.

All students may read the book and write a report to gain 4 extra points as needed for their grades. The report would consist of 20 interesting points, facts and concepts (about a paragraph each point with page number) that the student learned from the book.
One-day field trip in Salt Lake City to look at some geological outcrops. (Saturday, Date TBD) [Attendance and report will carry 4 points]. Long-distance students need to visit a natural history museum (or an oil field, geology) and write a brief report.

Other Useful Textbooks:

*Basic Petroleum Geology*, 3rd edition, Peter Link (OGCI Publications, 2009)


Articles:

Certain articles pertaining to the course will be introduced by the Instructor during the classes.

Evaluation and Grade Criteria

- Class participation 20 points
  (Including field trip and report, 4 points)
- 3 Tests (10 points each) 30 points
- Exercises (4 x 5 points each) 20 points
- Research Paper (a basin or field report) 30 points
  (14-16 pages + presentation 5 points)

Student should submit a brief description (title, study area and key references) of their research papers (by email to the Instructor) in Week 8.
Grading

A+ (100-96%)    A- (95-90%)
B+ (89-85%)    B- (84-80%)
C+ (79-70%)    C- (69-65%)
D (64-50%)

Class Work and Course Description

**MODULE I. GEO-KNOWLEDGE**

Week 1: Geoscience and Petroleum Industry: Foundations

*Reading materials:* Selley (Chapter 1); Bjorlykke (Chapter 1); Lambert (Chapter 1 & 12)

Week 2: Earth Materials: Minerals and Rocks

(Lecture presentation is the main reading material); Lambert (Chapters 3, 4 &5)

Week 3: Sedimentology and Depositional Environments

*Reading materials:* Bjorlykke (Chapters 3 & 2); Lambert (Chapters 6, 7, 8 & 9)

Week 4: Geologic Time and Stratigraphy

*Reading materials:* Bjorlykke (Chapters 7); Lambert (Chapters 10 & 11)

Week 5: Geologic Structures in Petroleum Basins

(Lecture presentation is the main reading material); Lambert (Chapter 5)

Week 6: Plate Tectonics and Basin Types

*Reading materials:* Selley (Chapter 8); Bjorlykke (Chapters 8 & 12); Lambert (Ch. 2)
MODULE II. THE PETROLEUM SYSTEM

Week 7: Petroleum Geochemistry and Source Rocks

Reading materials: Selley (Chapters 2 and 5); Bjorlykke (Chapters 14, 15 and 9)

Test 1 (for Module I of the course)

Week 8: Petroleum Reservoirs

Reading materials: Selley (Chapters 6); Bjorlykke (Chapters 4, 5)

Week 9: Petroleum Seals and Traps

Reading materials: Selley (Chapter 7); Bjorlykke (Chapters 20 and 11)

Week 10. Prospect Evaluation and Global Petroleum Resources

Reading materials: Selley (Chapter 10)

Week 11: Unconventional Petroleum Resources

Reading materials: Selley (Chapter 9); Bjorlykke (Chapters 21)

MODULE III. EXPLORATION TOOLS

Week 12: Geophysical Surveys

Reading materials: Selley (Chapter 3:3, 3:4 and 3:6); Bjorlykke (Chapter 17 and 19)

Test 2 (for Module II of the course)

Week 13: Seismic Interpretation and Sequence Stratigraphy

Reading materials: Relevant chapters from Week 12

Week 14: Well Logs and Subsurface Environments

Reading materials on well logs: Selley (Chapter 3:2); Bjorlykke (Chapter 16)
Reading materials on subsurface environments: Selley (Chapter 4); Bjorlykke (Chapter 10)

Week 15: Geologic Maps & Geology of North America
(Lecture presentation is the main reading material)

Week 16: Final Exam, Students’ Papers & Presentations (at EGI)
Including Test 3 (for Module III of the course)

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<table>
<thead>
<tr>
<th>Events</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Classes begin</td>
<td>Monday, August 24</td>
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<tr>
<td>Last day to add without a permission code</td>
<td>Sunday, August 30</td>
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<td>Last day to add, drop (delete), elect CR/NC, or audit classes</td>
<td>Friday, September 4</td>
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<tr>
<td>Last day to withdraw from classes</td>
<td>Friday, October 23</td>
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<tr>
<td>Last day to reverse CR/NC option</td>
<td>Friday, December 4</td>
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<tr>
<td>Classes end</td>
<td>Thursday, December 10</td>
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<tr>
<td>Final exam period</td>
<td>Mon.-Fri., Dec. 14-18</td>
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