PETE/GEOS 646

Petroleum Geology

3 credits

Hydrocarbons fuel today's economy, but remain a relatively rare natural resource. The objective of this course is to review the geologic controls on the distribution and accumulation of hydrocarbons, how those hydrocarbons are found, and how they are subsequently extracted. At the end of the course, students should be able to explain:

- the subsurface environment
- the origin and nature of hydrocarbons
- how and where hydrocarbons accumulate
- methods of hydrocarbon exploration and exploitation
- unconventional hydrocarbon resources
- basic reservoir engineering techniques

Examples from classic hydrocarbon-producing regions will be used to illustrate the principles and techniques discussed in class.

Students will be assigned additional readings each week that expand on the topics discussed in class. Students will then use the concepts and techniques discussed in both the class and the readings to research a petroleum topic related to their own area of research. Results will be summarized as a paper and presented to the class as a short presentation.

Prerequisites: Graduate standing or permission of the instructor

Instructor: Cathy Hanks, NSB 346/Duckering 417, 474-5562 or 2668
chanks@gi.alaska.edu

Office Hours: TBD

Text: Selley, 1999, Elements of Petroleum Geology. Academic Press, 470 p.

Additional readings will be assigned each week to augment the lectures.

Class format:

The class will consist of lectures and homework assignments. Additional readings will be assigned each week to augment the lecture material given in class.

Grading Policy

The course grade will be a letter grade (plus, minus) and will be based on:

- 2 mid-term exams (20% each)

- final exam (20% each)
- homeworks (20%)
- final project paper & oral presentation (20%)

Students will meet with the instructor during the first 2 weeks of class to determine the topic of the research project. The results of the project will be presented as an 8-10 page research paper, and in a 10 minute oral presentation to the class. Both papers and oral presentations will be graded on technical content and quality of presentation.

Grades will be assigned as follows:

A+ = 97-100%
A = 93-96
A- = 90-92
B+ = 87 - 89
B = 83-86%
B- = 80-82
C+ = 77-79
C = 73 – 76%
C- = 70 - 72
D+ = 65-69
D = 55-64%
D- = 50 - 54
F = <55%

The instructor reserves the right to curve the grades where appropriate.

Late homeworks will not be accepted.

COURSE OUTLINE: (28 CLASS DAYS)

Week	***Topic***	***Homeworks***	***Readings***
1	**Intro—Why petroleum?**		
	What is Petroleum? • Organic vs. inorganic origin of petroleum • Chemical Properties • Physical Properties		**Selley Ch. 2**
2	**The subsurface environment** • Temperature within the earth • Pressure • Subsurface waters	**Hwk 1: Calculating geothermal gradients**	**Selley, Ch. 4**
	Methods of Exploration • Drilling a well • Well logging	**Hwk 2: Rock id**	**Selley, Ch. 3.1, 3.2, 3.5**

3	• Subsurface geology and maps • Formation Evaluation	**Hwk 3: Examining well cuttings and well logs**	
	• Gravity and Magnetics		
4	• Geophysical methods—Reflection Seismic--acquisition	**Hwk 4: Interpreting seismic**	**Selley, Ch. 3.3**
	• Seismic interpretation, 3 D, 4D		
5	**The source: How oil forms** • Source rock characteristics • Productivity and Preservation of Organic Matter. • Hydrocarbon Maturation • Hydrocarbon Migration		**Selley, Ch. 5**
	Midterm I		
6	**The Reservoir:** **What makes a good reservoir rock?** • Porosity. • Permeability. • Effects of Diagenesis on Reservoir Quality.	**Hwk 5: Evaluating porosity and permeability in hand samples**	**Selley, Ch. 6.1-6.7**
	• Measuring reservoir properties o Lab measurements o Log evaluations		
7	• Reservoir Continuity—the importance of depositional environment: o Variations due to sed structure o Mesoscopic and map scale variations		
	• Carbonate depositional systems: a different beast	**Hwk 6: Correlating logs; Constructing subsurface isopach maps**	
8	• Reservoir prediction in the subsurface: the importance of sequence stratigraphy	**Hwk 7: Sequence stratigraphic interpretation of seismic data**	
	Traps and Seals: • Nomenclature of a Trap. • Distribution of Petroleum within a Trap.—Gas, oil, water • Characteristics of Seals and Cap Rocks.		**Selley, Ch. 7**

9	• Trap types: o Structural Traps. o Stratigraphic Traps. o Combination Traps. o Hydrodynamic Traps.	**Hwk 8: Constructing subsurface structure maps; Identifying play types from subsurface structure maps**	
	• Salt-related structures		
10	**<u>Midterm II</u>**		
	• Structural modifications of a reservoir: Fractured reservoirs		
11	• Timing of Trap Development Relative to Migration. **Petroleum systems & plate tectonic habitat** • Passive continental margins	**Hwk 9: Using seismic data for structural interpretation and timing**	**Selley, Ch. 8**
	• Passive continental margins, cont		
12	• Convergent margins • Strike slip basins	**Hwk 10: Plate tectonic setting of modern day basins**	
	Reservoir engineering: • Reserve calculations	**Hwk 11: Simple reserve calculation**	**Selley, Ch. 6.8-6.9**
13	**Well Drilling and Completion**		
	Non conventional hydrocarbon resources • Viscous oil • Gas hydrates • Coal bed methane		
14	• Tight gas • Shale resource plays		
	Student presentations		

Course Policies: Attendance at class is your responsibility. Students are responsible for making up any missed work. Students are encouraged to arrive to class on time. Make-up examinations will be held only under exceptional circumstances (e.g. illness, family crises, etc.). Medical documentation will be required to confirm illnesses. We follow the university guidelines for plagiarism/academic integrity as outlined in the current UAF catalog (p. 71-72).

Disability Services: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (208 Whitaker Building, 474-5655) to provide reasonable accommodation to students with disabilities.