

Petrophysics and Well Logging

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Meeting	Date	Subject(s)	Details (as necessary)	Chapters (in reference textbooks)
1		Introduction	Worldwide Distribution of Oil, Gas and Coal Resources, Global Usage, Future Demand and Price of Oil	
2		Fluid Properties	Origin of Petroleum. Types of Oil and Gas, Van Krevelen diagram, Source Rocks, TOC and Rock Eval, Oil Generation, Migration, Trapping, Reservoir Types	A: pp 44-81
3		Introduction to Rock Properties	What makes a reservoir rock? Porosity and Grain Density Archimede's Principle Oil/Water/Gas Saturations Permeability Klinkenberg-corrections to Gas Permeability Routine Core Analysis	A: 87-112 Handouts: Lab Expt#1: Porosity and Permeability: Coreval 30 Demo
4		Core Analysis I	Hydrocarbon saturations via Dean Stark extraction, Capillary pressure curves Thomeer and Swanson models of capillary pressure Free Water Level Gas-Oil-Water Contacts Carmen-Kozeny equation	A:313-354 "Introduction to Petrophysics of Reservoir Rocks" by G. Archie "Fundamental Reservoir Rock Properties" handouts in class

5		Core Analysis II	Formation Resistivity Factor, Archie's Laws, initial/residual saturations, relative permeability, wettability Special core analysis	A:203-211, 360-403 Lab Expt #2: "Electrical resistivity" Demo
6		Well Logging I	Wireline Logging: the well site, the borehole environment; SP, gamma ray, caliper, density, neutron, sonic, resistivity Clean Sand Analysis	B:17-58, 91-121, 293-379
7		Well Logging II	NMR Logging, Bulk Volume Oil, Bound Water, Irreducible Water Saturation, shaly sands	B: 415-473
8		Well Logging III	Borehole Imaging Tools, FMI, fluid sampling, MWD, Cased Hole Logging, RST, Pulsed Neutron Capture, Commercial Well Log Interpretation Software	B Lab Expt #3: Geolog Demo
9		Acoustic Logging. Earth Stresses and Rock Mechanics	Measuring Earth Stresses vs Depth; Elastic moduli of rocks, acoustic logging, Vp/Vs for gas detection, Stoneley waves, seismic applications	B: 479-566 Lab Expt #4: "Rock Mechanics" and "Acoustic Velocity" Demos
10		Primary Oil Recovery and Waterflooding	Reservoir drive mechanisms, static and dynamic geological models, numerical reservoir simulations, primary and secondary oil recovery: how rock properties affect sweep and displacement efficiencies	C
11		EOR Methods	EOR methods; thermal recovery for heavy oils. Piloting and Technology applicability. Field examples: How geology determines the recovery method	C
12		Case Study	Apply Core and Log Data to Evaluate Atoka Sandstone	Individual Log and Core Work
13		Review	Review Class	

Course Mechanics

- 1) **There will be 5 homework assignments which will be graded**
- 2) **There will be a final exam (multiple choice) but no midterm exam**
- 3) **The course grade will be 50% from homework assignments and 50% from the final exam**

Course textbooks

- A. **“Petrophysics”** by Tiab and Donaldson
- B. **“Well Logging for Earth Scientists 2nd Edition”** by Ellis and Singer
- C. **“Petroleum Production Systems”** by Economides et al.