Seminar title:

ements of Rock Physics

Duration [number of hours]: 4

Name and Contact Details of Lecturer(s):

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Course Description [max 150 words]:

The increasing of energy geo-resources exploration (gas, oil, geothermal energy) and also the needing of man-made hazard assessment (induced seismicity, etc) drives us to improve our knowledge of the earth's subsurface in terms of rock parameters. Rock Physics provides the understanding to connect the geophysical observables (velocity, impedance, attenuation), whose availability continuously increase, to the intrinsic properties of rocks, such as lithology, porosity, pore fluids content, etc. This seminar will give elements of rock physics with a focus on the main rock micro-parameters description, the Effective Medium Theory and the effect of pore-fluid presence in the medium, such as the Biot's theory of poroelasticity and the Gassman fluid substitution relations.

Syllabus [itemized list of course topics]:

Rock Physics Basic Concepts:
Rock physics; examples of application; rock physical models; scales of application; porous medium micro-parameters; Heterogeneous medium: Effective Medium Theory and poorly consolidated media.

Fluids effects and diffusion:
Saturation and permeability; Biot's theory of poroelasticity; Biot's velocities and attenuation (Pride's approach) and poroelastic moduli; Gassman's fluid substitution (isotropic form); Mixing fluids and partial saturation (Effective Medium Theory).

Suggested reading and online resources:

1. Guéguen, Yves, and Victor Palciauskas. Introduction to the Physics of Rocks. Princeton University Press, 1994. [Chapter II, III, V and VI]
2. Mavko, G., T. Mukerji, and J. Dvorkin (2009), The Rock Physics Handbook, Second Edition: Tools for Seismic Analysis of Porous Media, pp. 177–178, Cambridge Univ. Press, Cambridge, U. K. [Chapters 4, 5, 6 and 8]
3. Pride, S. R. (2005), Relationships between seismic and hydrological properties, in Hydrogeophysics, pp. 253–290, Springer, Netherlands.