Subsurface mapping by seismic methods

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Description of Course Content:

- Introduction to the methods of acquisition and processing of seismic reflection data.
- Basic theory of seismic waves traveling through the Earth and how they interact with earth materials and interfaces.
- Structural and stratigraphic interpretation methods and pitfalls using two and three dimensional seismic data.
- The application of seismic data to exploration and production of hydrocarbon deposits.

Student Learning Outcomes:

The successful student will understand the basic principles of seismic reflection data and will be able to interpret seismic lines across a variety of structural and stratigraphic settings. The student will be familiar with the operation of seismic interpretation software commonly used in the oil and gas industry (Petrel).

Requirements:

Basic computer skills and an understanding of algebra and trigonometry.

Basic geologic knowledge (stratigraphy, sedimentology) is required, courses such structural geology, earth physics/introduction to geophysics and GIS as a must.

Course content

1. W1- Introduction to seismic exploration (reflection, refraction, check shots,)
2. W1- Basic principles (frequency, resolution, sampling, semblance, velocities, Snell's law, basic rock physics, etc.)
3. W2- The seismic survey: land, marine, geometries, topography, 2D/3D/4D
4. W2- Introduction to data processing (S/N, CMP sorting, stacking, AGC, filters, deconvolution, static corrections, multiples), time migration

exam (1) – 20 questions

5. W3- Interpretation fundamentals
    a. lab + **exercise** and 2D paper exercise (time domain)

6. W4- Structural Interpretation & mapping: horizons, layers, faults, closure, unconformities, salt

    b. lab + **exercise** (Petrel/paper)

7. W5 – Intro to stratigraphic Interpretation: Basin through seismic, amplitude, wavelets, frequency, geometry of reflectors, DHI

8. W6- Velocity analysis – NMO, RMS velocity, Interval velocity, Time to Depth Conversion, Structures in time and in depth

    c. lab + depth conversion **exercise** (velocity survey, Dix and updating interpretation)

9. W7- Well Logs and synthetic seismograms, seismic - well Calibration

10. W8- computerized Interpretation lab

    d. building a project

    e. horizons maps – exercise – time map

    f. time to depth conversion

11. W9- Principles of 3D interpretation

12. W10- Principles of 3D interpretation

13. W11- 3D interpretation project

14. W12- 3D interpretation project

    g. 3D interpretation project: **exercise**- mapping trap with description

Rules:

Lectures 1-4; twice double class (2 weeks) – presence >75%

Exam (1) 25%

3 exercise 3X5%

3D interpretation exercise 30%

Final exam 30%