



Course Syllabus

Course Code	Course Title	ECTS Credits
GEOL-210	Petroleum Geology	6
Prerequisites	Department	Semester
N/A	Engineering	Fall
Type of Course	Field	Language of Instruction
Required	Oil and Gas Engineering	English
Level of Course	Lecturer(s)	Year of Study
1 st Cycle	Dr Stefano Patruno	2 nd
Mode of Delivery	Work Placement	Corequisites
Face-to-face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Understand in detail sediments, sedimentary rocks and what types of sedimentary rocks host and generate hydrocarbons.
- Define the concept of sedimentary facies, facies associations and the main sedimentary environments: where can you find good reservoir versus source facies?
- Understand the concept of geological time and the main geological eras, periods, stages
- Explain how rock successions are affected by stratigraphic unconformities and tectonic deformation (faults, folds)
- Distinguish conventional from non-conventional geological reserves.
- Illustrate the conditions of conventional petroleum accumulation.
- Provide technical knowledge for understanding the mechanisms of hydrocarbon generation and migration.
- Define the concepts of the two main petrological parameters of a reservoir (Porosity and Permeability-Darcy fluid flow law).
- Examine how the tectonic stress field creates petroleum traps.
- Underline the importance of cap/seal rocks and their importance in petroleum exploration.
- Demonstrate the concept of the petroleum system in sedimentary basins.
- Define the basic concepts of prospectivity and play fairways analysis during oil and gas exploration and development.
- Introduce the students to basin analysis and burial history modelling
- Introduce the students to volumetric analysis and perform preliminary calculations for in-situ reserves.

Introduce the students to the practical basics of 1D, 2D and 3D geological assessment and prediction tools during the exploration and development stage: well log analysis, core analysis, gravity and magnetics, seismic interpretation, sequence stratigraphy

Learning Outcomes:

After completion of the course students are expected to be able to:

- Review in details sediments and sedimentary rocks, including the concepts of facies, facies association and sedimentary environments.
- Understand how rocks are deformed, developing stratal terminations, folding and faulting
- Explain the concept of geological time and its subdivision (geological time scale)
- Understand in detail the five critical elements for a conventional oil and gas accumulation: source, migration, reservoir, seal, trap (petroleum system and plays)
- Identify which types of rocks host most oil and gas.
- State the mechanisms of hydrocarbon generation from parent rocks and migration to the petroleum trap.
- Specify the importance of the cap and seal rocks in the petroleum system.
- Distinguish the petrophysical parameters of reservoirs such as porosity (storage) and permeability (Darcy fluid flow law).
- Perform basic basin and prospectivity analyses at different scales: e.g., play fairway analysis.

Course Content:

- Sedimentary rocks (formation of rocks by surface processes)
- Sedimentology of carbonate rocks (chemical and biological sediments)
- Sedimentology of sandstone and claystone rocks (siliciclastic sediments)
- Facies, facies associations and sedimentary environments
- Rock deformation: stratal terminations, folds, faults
- Basic concepts of basin analysis.
- Introduction to conventional petroleum reservoirs.
- Generation of Hydrocarbons in the parent rock.
- Migration of Hydrocarbons to the reservoir.
- Creation of hydrocarbon Traps from tectonic processes
- Seal and Cap rocks on top of reservoirs.
- Reservoir major characteristics (Porosity, Permeability and Pressure)
- Reserves preliminary calculations.
- The petroleum system (a time depended physical process).
- Prospectivity analysis during the exploration and development phases: e.g., play fairways analysis
- Introduction to geological assessment and predictive tools: e.g., seismic interpretation, sequence stratigraphy, 1D basin modelling and software (Kingdom, Petrel)

Learning Activities and Teaching Methods:

Lectures, in-class examples, tutoring exercises, projects, discussion

Assessment Methods:

Mid-term exam, Project report, Final Exam.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Elements of Petroleum Geology 3rd ed.	Selley R.C. and S.A. Sonnenberg	Academic Press	2015	9780123860316
Understanding Earth 7th Edition	John Grotzinger and Tom Jordan	Macmillan Learning	2014	9781464138744

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Petroleum Geoscience	Jon Gluyas and Richard Swarbrick	Wiley-Blackwell	2017	9780632037674