**MSc Energy Resources**

**List of courses offered in English in the framework of the Master programme Earth Science and Environment**

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| **Semester** | **Cours** | **ECTS** |
| **S8 - SPRING**15 January 2019 – 6 July 2019 | Petroleum Field Assessment | 2 |
| Geomodeling | 2 |
| Applied GIS and Remote sensing | 2 |
| Seismic stratigraphy | 2 |
| Sequence stratigraphy field trip  | 2 |
| Offshore Geohazards and Geotechnics | 1 |
| French as Foreign Language | 2 |
| **TOTAL** | **13** |
| **S9 - FALL**3 September 2018 – 14 January 2019 | Well data integration | 1,5 |
| Case studies | 1 |
| Fracturing & Sedimentary Fluids | 1 |
| Exploration Geophysics | 3 |
| Geomodeling | 2 |
| Structural modeling | 2 |
| Sedimentological modeling | 2 |
| Petroleum Geology Team Project | 12 |
| French as Foreign Language | 2 |
| **TOTAL** | **26,5** |

NB: The prerequisites in the course syllabi mention the courses at UniLaSalle. Courses with equivalent content taken at the partner university are accepted.

Last update : 17/02/2020

Course syllabi

[**Petroleum Field Assessment** 3](#_Toc509630373)

[**Geomodeling** 5](#_Toc509630374)

[**Applied GIS and Remote sensing** 6](#_Toc509630375)

[**Seismic stratigraphy** 7](#_Toc509630376)

[**Sequence stratigraphy field trip** 8](#_Toc509630377)

[**Geohazards and offshore geotechnics** 10](#_Toc509630378)

[**French as Foreign Language** 11](#_Toc509630379)

[**Well data integration** 13](#_Toc509630380)

[**Case Studies** 14](#_Toc509630381)

[**Fracturing and sedimentary fluids** 15](#_Toc509630382)

[**Exploration Geophysics** 16](#_Toc509630383)

[**Geomodeling, prospect evaluation and reservoir initiation** 18](#_Toc509630384)

[**Structural modeling** 19](#_Toc509630385)

[**Sedimentological modeling** 20](#_Toc509630386)

[**Petroleum Geology team project** 21](#_Toc509630387)

[**French as Foreign Language** 23](#_Toc509630388)

# **Petroleum Field Assessment**

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| **Geology** |

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| **4th Year GeologySemester 8** |

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| **Program information** |

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| **Petroleum Field Assessment** |

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| **2017-2018** |

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| **(Evaluation pétrolière)Department: G.E.O.S.** |  |
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| **Coordinator: Y.VAUTIER** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **20h** | **2h** |  **0h** |  **12h** | **0h** | **0h** | **0h** | **0h** |  **20h** |

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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Geodesy (Spatial Tools teaching unit, Year 1), Economics of Natural Resources (Economics and Mapping teaching unit, Year 2), Sedimentary Basins (Tectonics and Sedimentation teaching unit, Year 2), Presentation and Introduction to Professions in PETROLEUM GEOLOGY (Business Sectors and Geology Professions teaching unit, Year 3), Geophysics/Signal Processing – Drilling – Well Logging (Engineer Tools and Techniques teaching unit, Year 3), Geomatics (teaching unit 30 – Geomatics, Year 3), Petroleum Exploration teaching unit 1 – Year 4 (Principles of E&P, Petrophysics, Petroleum Geochemistry, Acquisition and Processing in Land Seismic Reflection) |
| **By the end of the module, students will be able to (objectives):** |
| Understand the major stages in the petroleum evaluation process, from the initial recognition stage to the identification of prospective petroleum resources, and incorporate the economic parameters of the petroleum industry.Understand how to integrate a petroleum evaluation project into a restrictive administrative and legislative framework (licenses, joint ventures, etc.). Basic introduction to decision-making and investment risk: given the scale of investment required for most oil projects, it is important for investment decisions to be based on a thorough analysis of variables and uncertainties. Basic introduction to investment projects: this course provides a thorough, practical grounding in the techniques used in the petroleum industry for investment projects, assets and companies. Introduction to the general economic principles of the petroleum industry: the material starts with the general economic principles of energy and then goes into more depth with a detailed analysis of the upstream and downstream sectors of the industry. It also looks at specific issues related to the petroleum industry such as tax systems, risk analysis and competition, giving students the skills they need to answer questions such as:o How will it work? o How much will it cost? o What will the return be? |
| **Content:** |
| A/ Petroleum evaluation module: 1/ Principles of petroleum evaluation (6 hours, lecture)a/ The stages of petroleum evaluation and the importance of the concept – 1 hour, lectureb/ Work flow (determining themes, petroleum results, evaluating the "kitchen" generator system, drainage area, reservoir/cap rock, traps and cap rock efficacy), risk analysis with identification of weak points, post mortem evaluation and analysis – 3 hours, lecturec/ Evaluation of petroleum potential: method (country maps; prospective petroleum analysis; risk analysis, loading and volume calculation) – 2 hours, lecture2/ Practical exercises: Practical work applied to the evaluation of prospective petroleum resources (10 hours)3/ Petroleum economics: Petroleum economics, contracts and licenses, energy implications (14 hours, lecture + 2 hours, practical work).• Introduction to the idea of the energy economy and how it has developed, links with the economics of natural resources• Introduction to petroleum industry management: stakeholders, decisions and investment methods, basics of cash flow, income and profit, etc.• Upstream petroleum economics: cash flow, projected oil prices, reserves, production profiles of oil companies, royalties and production rights, joint ventures• Downstream petroleum economics: petroleum transportation and its costs, the costs of pipelines, costs and revenue associated with refineries, the distribution of petroleum products and related costs, bioethanols vs. oil• Managing the risks of petroleum economics: identifying risks, types of risks (geopolitical, land and subsoil, etc.), decision-making risks related to the development of an oil field, the cost of risks related to negotiations on the oil market• Evaluating oil reserves (market value and risk), the risk associated with evaluating oil reserves, the portfolio approach, factors influencing mergers on the oil market, business evaluation methods |
| **Teaching staff:** |  |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Exam | 1h | 40% | Principles of petroleum evaluation |
| Assessment 2 | Report | 0h | 40% | Practical work – Petroleum evaluation (report submitted) |
| Assessment 3 | Exam | 1h | 20% | Petroleum economics |

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# **Geomodeling**

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| **Geology** |

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| **4th Year GeologySemester 8** |

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| **Program information** |

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| **Geomodeling** |

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| **2017-2018** |

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| **(Géomodélisation)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **16h** | **0h** |  **0h** |  **0h** |  **12h** | **0h** | **0h** | **0h** |  **40h** |

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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Geodesy (Spatial Tools teaching unit, Year 1), Economics of Natural Resources (Economics and Mapping teaching unit, Year 2), Sedimentary Basins (Tectonics and Sedimentation teaching unit, Year 2), Presentation and Introduction to Professions in PETROLEUM GEOLOGY (Business Sectors and Geology Professions teaching unit, Year 3), Geophysics/Signal Processing – Drilling – Well Logging (Engineer Tools and Techniques teaching unit, Year 3), Geomatics (teaching unit 30 – Geomatics, Year 3), Petroleum Exploration teaching unit 1 – Year 4 (Principles of E&P, Petrophysics, Petroleum Geochemistry, Acquisition and Processing in Land Seismic Reflection) |
| **By the end of the module, students will be able to (objectives):** |
| Understand the benefits of basin and petroleum system modeling in petroleum geology. Understand the basic principles and tools for modeling petroleum geology data (well logs, 2D/3D seismic interpretation, geochemistry, structural analysis, etc.) used in exploration/production;Understand the various applications of Petrel: well correlation, 2D and 3D seismic interpretation, 3D mapping, 3D visualization, etc. |
| **Content:** |
| B/ Geomodeling module: Petrel project (16 hours, lecture + 12 hours, self-study)1/ Presentation of petroleum geology modeling – 2 hours, lecture; 2/ Presentation of Petrel and its main features – 4 hours, lecture; 3/ Example of data modeling and interpretation – 10 hours, lecture + 12 hours, self-study |
| **Teaching staff:** |  |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 20% | Geomodeling – Petrel modeling |

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# **Applied GIS and Remote sensing**

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| **Geology** |

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| **4th Year GeologySemester 8** |

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| **Program information** |

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| **Applied GIS and Remote sensing** |

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| **2017-2018** |

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| **(SIG et télédétection appliqués)Department: G.E.O.S.** |  |
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| **Coordinator: O.BAIN** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
| **0h** | **0h** |  **0h** |  **16h** | **4h** | **0h** | **0h** | **0h** |  **20h** |

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| **ECTS credits:2** |

 |
|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Applied GIS and Remote sensing: 3rd Year GIS – Databases – Remote sensing |
| **By the end of the module, students will be able to (objectives):** |
| Applied GIS and Remote sensing:Tackle a real-world problem (hydrogeology – mining – environmental – petroleum) using geomatics toolsCombine several tools (databases, GIS and remote sensing) to develop an argumentPerform multi-source and multi-criteria spatial analysesCommunicate via map semantics |
| **Content:** |
| Applied GIS and Remote sensing:• Projects in groups of 4 or 5 organized according to specialization• Introduction to spatial analysis techniques• Principles for interpreting medium- and high-resolution images• Developing applications using ArcInfo• Project management• Principles of cartosemioticsall associated with project management |
| **Teaching staff:** | O.BAIN, A.COMBAUD |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 100% | Applied GIS and remote sensing associated with project management |

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# **Seismic stratigraphy**

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| **Geology** |

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| **4th Year GeologySemester 8** |

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| **Program information** |

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| **GG4202** |

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| **Seismic stratigraphy** |

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| **2017-2018** |

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| **(Stratigraphie sismique)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **0h** |  **1h** |  **12h** |  **12h** |  **0h** |  **0h** |  **0h** |  **0h** |  **20h** |

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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Paleontology, Cartography, Sedimentary Petrography (Materials teaching unit, Year 1), Geodynamics and Deformation teaching unit (Year 1), Sedimentology teaching unit (Year 2), Tectonics and Sedimentation teaching unit (Year 2), Geophysics – Drilling – Well Logging (Engineer Tools and Techniques teaching unit, Year 3), Reservoirs and Petrophysics (Dynamics of Porous Environments teaching unit, Year 3), Petroleum Exploration teaching unit 1 (Year 4). |
| **By the end of the module, students will be able to (objectives):** |
| Seismic stratigraphy module:Perform structural and stratigraphic interpretation, on paper and using software (Kingdom Suite), of 2D and 3D seismic lines in different geological contexts that are likely to contain petroleum deposits/reservoirs. |
| **Content:** |
| Seismic stratigraphy module:• Reminders of the basic principles of seismic interpretation,• Seismic stratigraphy and its contribution to sequence stratigraphy,• Practical exercises in seismic picking and mapping on paper and using software (Kingdom Suite): identification and characterization using geophysical data (seismic lines, well logs and multibeam bathymetry) from basins, structures and remarkable sedimentary systems/bodies (basins on passive and active margins, salt diapirs, salt rafts, gravity slides, mass transport complex, roll-over, channels, submarine dunes, deep-sea cones, etc.). |
| **Teaching staff:** | J.BAILLEUL, E.INTERVENANT, L.GRANSAC, S.BROCHERAY |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Exam | 1h | 50% | Seismic stratigraphy exam (on paper) |
| Assessment 2 | Report | 0h | 50% | Report on Kingdom Suite practical work |

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# **Sequence stratigraphy field trip**

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| **Geology** |

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| **4th Year GeologySemester 8** |

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| **Program information** |

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| **Sequence stratigraphy field trip**  |

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| **2017-2018** |

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| **(Ecole de Terrain en stratigraphie séquentielle)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Paleontology, Cartography, Sedimentary Petrography (Materials teaching unit, Year 1), Geodynamics and Deformation teaching unit (Year 1), Sedimentology teaching unit (Year 2), Tectonics and Sedimentation teaching unit (Year 2), Geophysics – Drilling – Well Logging (Engineer Tools and Techniques teaching unit, Year 3), Reservoirs and Petrophysics (Dynamics of Porous Environments teaching unit, Year 3), Petroleum Exploration teaching unit 1 (Year 4). |
| **By the end of the module, students will be able to (objectives):** |
| Sequence stratigraphy module:• Analyze existing facies and build up a coherent depositional profile.• Understand the sequential organization of facies in different depositional environments and perform a stratigraphic breakdown of the various orders, from the elementary depositional sequence to basin fill megasequences.• Understand the principles, different approaches and specific terminology related to sequence and genetic stratigraphy (orbital cycles, transgression/regression, eustasy, notion of available space, nomenclature and identification of stratigraphic surfaces and systems tracts, etc.).• Understand internal and external forcings (climatic and eustatic, tectonic).• Organize and prioritize sequence identification so as to establish chronostratigraphic correlations for the basin or reservoir and develop predictive fill models.• Perform a cross-sectional survey and organize information gathered in the field by using the documents provided.• Present digital documents and summarize results.• Apply knowledge and techniques to meet industry needs. |
| **Content:** |
| • Sequence stratigraphy field school:This five-day field school is designed to give students an opportunity to apply basic sequence analysis techniques (analysis of facies and sedimentary bodies, key elements of stratigraphic architecture, bed-by-bed cross-sectional surveys, monitoring remarkable surfaces, correlations). It is based on a role play simulation of a situation that might be encountered in industry. The work is carried out in groups of 3 to 4 students. Discussions between the various groups should help them harmonize their results, providing a more comprehensive overview of the sectors studied and proposing correlations.The field work will be carried out at the tertiary era sites in Digne-Les-Bains (Rousset ravine or Châteauredon, Esclangon, "Le Vélodrome") and the Barrême syncline. The architectures of the fluvial and coastal environment will be detailed by case studies related to three specific issues:1) Re-evaluation of the gas storage potential of a formation through the stratigraphic analysis of a similar area: facies, depositional environment, architecture and geometry of the reservoirs (lateral continuity and sand-body connectivity) of a fluvial formation, better restricting potential effective volumes.2) Facies and sequence identification of the marine Miocene to characterize potentially accessible subsurface reservoirs and identify aspects of correlation, predictability and expected log response.3) A “Quick Look” (QL) analysis of the placer gold mining potential of the Eocene Nummulites in the Barrême syncline: basin sedimentology and stratigraphy, sequence identification, correlations, target and prospective systems, focus on prodelta and delta-fan environments.Data formatting and summary techniques will be taught in practical sessions in the evening. Each group should submit a general report using a relevant PowerPoint model at the end of the internship.Reference works:Catuneanu O. (2006). Principles of Sequence Stratigraphy. Elsevier ed.Posamentier H.W. and Allen G.P. (1999). Siliciclastic Sequence Stratigraphy – Concepts and Applications. SEPM ed.Coe A.L. (2005). The Sedimentary Record of Sea-Level Change. Cambridge ed. |
| **Teaching staff:** | J.BAILLEUL, R.TOULLEC |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 35% | Sequence stratigraphy field report |

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# **Offshore Geohazards and Geotechnics**

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| **Geology** |

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| **4th Year GeologySemester 8** |

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| **Program information** |

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| **Offshore Geohazards and Geotechnics** |

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| **2017-2018** |

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| **(Geohazards et Géotechnique offshore)Department: G.E.O.S.** |  |
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| **Coordinator: J.VERNHES** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **12h** | **2h** |  **10h** |  **0h** | **0h** | **0h** | **0h** | **0h** | **0h** |

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| **ECTS credits:**1 |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Engineer tools and techniques |
| **By the end of the module, students will be able to (objectives):** |
| Gain insight in offshore geohazards and offshore geotechnics, capability to asses a range of practical situations through calculations |
| **Content:**Offshore Industry Overview and contextTypes of subsea foundations, Offshore anchorsSubsea foundation calculationsPlatform foundations + Driven piles ExercicesShore approach (trenching/dredging)+ soil and pipes interactionsOffshore GeohazardsReconnaissance of offshore soils, Lab testing, soil parameters interpretation + exercices |
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| **Teaching staff:** | D. OREJUELA, E. SERRA (SUBSEA7) |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Exam | 1h | 50% | Exam n° 1 |
| Assessment 2 | Exam | 1h | 50% | Exam n° 2 |

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# **French as Foreign Language**

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| **Geosciences** **French as a Foreign Language 1** | **2018-2019** |
| **Faculty: Dr. Martine REY et al.** | **Module:****Beginning French**  | **Time :****24 contact hrs. & interactive assignments****HW: 12 hrs.****Exam: 2 hrs.**  | **2 ECTS credits****1 US credit** |
| **Numerus clausus : 20** |
| **Prerequisite:** none |
| **Objective:** Students will acquire the basic skills to use French in everyday situations  |
| **Description:**. This language course aims at providing students with the necessary language tools to interact successfully in a variety of situations and settings, for example at a farmers’ market or while traveling. Students will continue to learn French outside the classroom by practicing their acquired skills and adding new ones, for example by reading product labels in French, or asking questions during campus events, at a restaurant or in local businesses.. Interactive assignments will therefore complement classroom instruction. Students will be expected to participate actively, using the language skills they are learning inside and outside the classroom.**Course content** :* Basics of French language; “*when in France*” – culturally appropriate does and don’ts
* Describe, narrate, and ask/answer questions in the foreign language in the present time about a variety of topics related to family, daily activities, eating, and traveling.
* Comprehend the foreign language with sufficient ability to grasp the main idea in short conversations pertaining to the topics mentioned above.
* Read and understand the main idea and some details of materials related to daily life and travel (maps, classified ads,)
* Write sentences and short paragraphs on familiar topics relating to personal interests and practical needs. (e.g. postcards)

**Course material** includes: * Music (e.g. Nino Ferrer, Charles Aznavour)
* Food art
* Excerpts from French literature (e.g Emile Zola, *Le Ventre de Paris*)
* Films & video (e.g. *After Winter, Spring; Demain (Tomorrow); Nos enfants nous accuserons (Food Beware)*),
* Menus and descriptions of regional French products.
 |
| **Instructor:**Martine Rey, Associate Professor of Languages and Cultural Studies et al. |
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| **Assessment:**

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| **Assignments:** | **Method:** | **Time limit (for supervised tests):** | **Weighting:** |
| Class participation | Preparation for class and class discussion | N/A | 30% |
| Communication tasks | Interactive, real life assignments using French | N/A | 30% |
| Final Exam |  |  | 40% |

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| **Geosciences** **French as a Foreign Language 2** | **2018-2019** |
| **Faculty: Dr. Martine REY et al.** | **Module:****Intermediate French**  | **Time :****24 contact hrs. & interactive assignments****HW: 12 hrs.****Exam: 2 hrs.**  | **2 ECTS credits****1 US credit** |
| **Numerus clausus : 20** |
| **Prerequisite:** French 102 or equivalent |
| **Objective:** this course is designed for students at an intermediate level. The goal is to consolidate and improve skills previously acquired in French (101/102, or equivalent). |
| **Description:**. This language course allows students to explore French language and culture in a variety of situations and settings. Students will continue to learn French outside the classroom by practicing their acquired skills and adding new ones, for example by actively participating in campus events, or interacting in everyday life. Interactive assignments will therefore complement classroom instruction. Students will review grammar and phonetics to improve their communication skills. Classes are conducted entirely in French.**Course content** :* Speak the foreign language well enough to communicate on a variety of topics important in the foreign language culture that go beyond needed to “survive” in the foreign culture.
* Read and understand the main idea and most details in material about a variety of topics.
* Write longer paragraphs that show more cohesion than at the elementary level.
* Review of the most basic grammar structures

**Course material** includes: * Music (e.g. George Brassens, Nino Ferrer)
* Magazines and newspapers
* Films & video (e.g. *After Winter, Spring; Demain (Tomorrow); Nos enfants nous accuserons (Food Beware)*),
 |
| **Instructor:**Martine Rey, Associate Professor of Languages and Cultural Studies  |
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| **Assessment:**

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| **Assignments:** | **Method:** | **Time limit (for supervised tests):** | **Weighting:** |
| Class participation | Preparation for class and class discussion | N/A | 30% |
| Communication tasks | Interactive, real life assignments using French | N/A | 30% |
| Final Exam | Oral and written exam |  | 40% |

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# **Well data integration**

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| **Geology** |

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| **5th Year GeologySemester 9** |

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| **Program information** |

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| **Well data integration** |

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| **2017-2018** |

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| **(Données de puits)Department: G.E.O.S.** |  |
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| **Coordinator: R.TOULLEC** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
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| **ECTS** credits**:1,5** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Facies Sedimentology (Year 2), Engineer Tools and Techniques, "Logging and Drilling" section (Year 3), Advanced Logging (Year 4) |
| **By the end of the module, students will be able to (objectives):** |
| -Describe data about core samples from oil and gas drilling from a sedimentological, diagenetic and structural point of view in carbonate and siliciclastic systems.-Incorporate well logging and petrophysical data to suggest models for reservoir subdivision into layers. -Provide a brief presentation of data using software such as "WellCAD" and "Techlog".-Understand the possible interpretation bias associated with drilling/coring and logging data; Quality control (QC). |
| **Content:** |
| This module is taught in conjunction with Lundin Petroleum (François-André Duboin and Alain Buisson)Program: -Teaching (2 hours): Integration of well data into the petroleum workflow. General presentation-Description of core samples (from conventional and/or sidewall coring) in operational conditions (1 or 2 days): place to be confirmed (probably either the Lundin or Gaz de France core sample collections [TBD]). Integration with logging data (mud logging, LWD (logging while drilling), MWD (measurement while drilling) and conventional well logging after drilling)-Well monitoring, mud logging directly in the field (if an opportunity arises) (1 day), otherwise practical work on thin sections produced from cuttings (1 day)-Use of "professional" software to present and interpret data (WellCAD and Techlog)-Writing an operational report in English (probe report) and giving a 15-minute oral presentation in industry conditions |
| **Teaching staff:** | F.DUBOIN |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 80% |  |
| Assessment 2 | Oral | 0h15 | 20% |  |

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# **Case Studies**

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| **Geology** |

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| **5th Year GeologySemester 9** |

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| **Program information** |

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| **Case Studies** |

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| **2017-2018** |

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| **(Etudes de Cas)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **15h** |  **0h** |  **6h** |  **0h** |  **0h** |  **0h** |  **0h** |  **0h** |  **8h** |

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| **ECTS credits:1** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Sedimentary Petrography (Year 1), Cartography (Year 1 and Year 2), Sedimentology teaching unit (Year 2), Tectonics and Sedimentation teaching unit (Year 2), Introduction to Petroleum Geology (Year 3), Exploration Tools: Drilling/Logging/Seismology (Year 3), Petroleum Exploration teaching units 1 and 2 (Year 4), Seismic and Sequence Stratigraphy teaching unit (Year 4) |
| **By the end of the module, students will be able to (objectives):** |
| • Integrate different types of data from different disciplines and scale up,• Integrate and combine strategic, economic, industrial, operational and geological approaches in case studies. |
| **Content:** |
| • Two integrated case studies:the Athabasca oil sands (12 hours), petrophysical/sedimentological/stratigraphic/seismic integration based on the example of the Boulonnais cliffs (6 hours).• A third variable case study depending on the year (3 hours),e.g. carbonates or Andean foreland in Peru |
| **Teaching staff:** | J.BAILLEUL, G.MAHIEUX, R.TOULLEC |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 100% | Graded exercises – Challenges and case studies |

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# **Fracturing and sedimentary fluids**

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| **Geology** |

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| **5th Year GeologySemester 9** |

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| **Program information** |

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| **Fracturing and sedimentary fluids** |

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| **2017-2018** |

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| **(Fracturation et fluides sédimentaires)Department: G.E.O.S.** |  |
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| **Coordinator: E.SAILLET-POURRET** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **12h** | **2h** |  **0h** |  **0h** | **0h** | **0h** | **0h** | **0h** | **6h** |

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| **ECTS credits:1** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** |  |
| **By the end of the module, students will be able to (objectives):** |
| - Characterize the different mechanisms of brittle deformation in granular and non-granular materials.- Characterize the composition and PVT properties of sedimentary fluids and paleofluids, especially by interpreting the results of fluid inclusion analysis (microthermometry). |
| **Content:** |
| - Fracture theories and micromechanisms of fracture- Micromechanisms of fracture in porous and less porous rocks- Introduction to the role of fluids in deformation- Characterization of fluids and paleofluids in sedimentary basins: composition of sedimentary fluids, PVT (pressure-volume-temperature) properties,- Phase relationships in aqueous systems, gas systems and hydrocarbon mixtures,- Fluid inclusions: formation, importance and use, analysis techniques, advantages and shortcomings of the method, examples, etc. |
| **Teaching staff:** | M.DUBOIS |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Exam | 2h | 100% |  |

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# **Exploration Geophysics**

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| **Program information** |

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| **GG5105** |

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| **Exploration Geophysics** |

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| **2017-2018** |

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| **(Géophysique d'exploration)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **18h** | **0h** |  **9h** |  **15h** | **0h** | **0h** | **0h** | **0h** |  **18h** |

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| **ECTS credits:3** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Facies Sedimentology (Year 2), Introduction to Petroleum Geology (Year 3), Principles of Seismology (Year 3), Acquisition and Processing in Seismic Reflection (Year 4), Petroleum Exploration 1 and 2 (Year 4), Seismic and Sequence Stratigraphy (Year 4), Signal Processing |
| **By the end of the module, students will be able to (objectives):** |
| • Understand acquisition methods in marine seismology and their applications,• Understand the different stages in acquisition planning and the difficulties involved,• Grasp the principles behind 3D marine seismic data processing, use these data for the purposes of petroleum exploration and reservoir characterization,• Use and interpret seismic attributes,• Understand the principles of seismic geomorphology and perform interpretations in carbonate and siliciclastic systems. |
| **Content:** |
| Exploration Geophysics:Day 1 – morningIntroduction to exploration geophysicsReminder of the basics of wave propagation in seismic reflectionPreparation and implementation of a seismic campaignDay 1 – afternoonPresentation of the various types of 3D marine seismic acquisitionElectromagnetic acquisitionsDay 2 – morningDesigning a marine seismic acquisitionExercisesDay 2 – afternoonSite survey: Different acquisitions, interpretation methodExercise using Petrel and/or on paperDay 3 – morningGeneral seismic attributes: analysis of seismic amplitudes, spectral decomposition, etc.ExercisesDay 3 – afternoonAdvanced seismic attributes: AVO, inversion, spectral decompositionExercisesDay 4 – morningVertical seismic profile, seismic calibrationExercisesDay 4 – afternoonPractical exercise using Petrel: Well analysis, well/seismic calibration, 3D interpretationDay 5Practical exercise using Petrel: Screening seismic cubes, mapping prospects and leads, time-depth conversion, amplitude analysis, volume calculation, calculating success probabilities, presenting results to the class.Seismic geomorphology:Introduction to seismic geomorphology (definition, aim and method) and practical exercises in different deposit environments. |
| **Teaching staff:** | J.CAMY-PEYRET, N.NOSJEAN |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 75% | Graded exercises in petroleum geophysics |
| Assessment 2 | Oral | 0h | 25% | Presentation of the results of Petrel practical work to the class |

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# **Geomodeling, prospect evaluation and reservoir initiation**

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| **Program information** |

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| **Geomodeling, prospect evaluation and reservoir initiation** |

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| **2017-2018** |

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| **(Géomodélisation, évaluation de prospect et initiation réservoir)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
|  **0h** |  **0h** |  **30h** |  **0h** |  **0h** |  **0h** |  **0h** |  **0h** |  **18h** |

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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Sedimentary Petrography (Year 1), Cartography (Year 1 and Year 2), Sedimentology teaching unit (Year 2), Tectonics and Sedimentation teaching unit (Year 2), Introduction to Petroleum Geology (Year 3), Exploration Tools: Drilling/Logging/Seismology (Year 3), Petroleum Exploration teaching units 1 and 2 (Year 4), Seismic and Sequence Stratigraphy teaching unit (Year 4) |
| **By the end of the module, students will be able to (objectives):** |
| • Produce a static 3D model by following the dedicated workflow,• Demonstrate hindsight and critical analysis skills to validate the data used,• Carry out a prospect evaluation from the geological summary to calculations of volumes and risks,• Interpret models with an analytical and critical approach to the results obtained,• Communicate with reservoir engineers using their terminology and understanding their needs and objectives. |
| **Content:** |
| • Petrel training (30 hours): stages in the production of a static 3D model using real data, integration of this model in the prospect evaluation workflow.• Introduction to reservoir engineering (6 hours): basics of reservoir geology, flow and principles of dynamic modeling. |
| **Teaching staff:** | E.INTERVENANT, B.CLAUSSMANN, E.BESSE |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | 100% | Graded tutorial exercises |

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# **Structural modeling**

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| **Program information** |

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| **Structural modeling** |

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| **2017-2018** |

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| **(Modélisation structurale)Department: G.E.O.S.** |  |
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| **Coordinator: G.TRULLENQUE** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
| **6h** | **2h** |  **12h** |  **0h** |  **0h** |  **0h** |  **0h** |  **0h** |  **12h** |

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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Cartography (Year 1 and Year 2), Sedimentology teaching unit (Year 2), Tectonics and Sedimentation teaching unit (Year 2), Introduction to Petroleum Geology (Year 3), Exploration Tools: Drilling/Logging/Seismology (Year 3), Petroleum Exploration teaching units 1 and 2 (Year 4), Seismic and Sequence Stratigraphy teaching unit (Year 4) |
| **By the end of the module, students will be able to (objectives):** |
| • Understand the principles of experimental modeling (analog)• Use the concepts of gravity tectonics in the context of oil exploration and production (E&P)• Import SEG-Y data, drilling data, stratigraphic column data, MNT files and maps into the Move software suite• Produce a 3D model using imported data and use it to construct geological sections• Handle digital geological cross-sections and apply deformation algorithms. |
| **Content:** |
| • Experimental modeling: principles, structures and salt tectonics (12 hours)• Introduction to the Move software suite• Loading and calibrating data• Developing a Move model• Developing and handling cross-sections |
| **Teaching staff:** | B.VENDEVILLE, G.TRULLENQUE |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Exam | 2h | 80% | Experimental modeling and salt tectonics exam |
| Assessment 2 | Report | 4h | 20% | Developing and handling a computer-based Move model |

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# **Sedimentological modeling**

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| **Program information** |

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| **Sedimentological modeling** |

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| **2017-2018** |

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| **(Modélisation sédimentologique)Department: G.E.O.S.** |  |
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| **Coordinator: Y.VAUTIER** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
| **2h** | **0h** |  **6h** |  **10h** | **0h** | **0h** | **0h** | **0h** | **9h** |

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| **ECTS credits:2** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Sedimentology teaching unit (Year 2), Tectonics and Sedimentation teaching unit (Year 2), Introduction to Petroleum Geology (Year 3), Petroleum Exploration teaching unit 1 and 2 (Year 4), Seismic and Sequence Stratigraphy teaching unit (Year 4) |
| **By the end of the module, students will be able to (objectives):** |
| • Collect the data needed to produce models to evaluate source rock potential,• Demonstrate hindsight and critical analysis skills to validate the data,• Produce organic matter maturation models and burial histories (basin modeling using PetroMod),• Understand the data needed and the potential of stratigraphic modeling in R&D (e.g. DionisosFlow),• Interpret models and integrate them into the E&P workflow, maintaining an analytical and critical approach to the results obtained. |
| **Content:** |
| • Principles of stratigraphic modeling (e.g. DionisosFlow) – 6 hours• Source rock modeling: developing burial histories/maturation models and evaluating source rock potential (e.g. PetroMod) – 12 hours |
| **Teaching staff:** | S.ROUSSE, Y.VAUTIER, E.INTERVENANT |
| **Assessment (procedures and weightings):** |
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|  Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Report | 0h | Graded exercises |  |

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# **Petroleum Geology team project**

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| **Program information** |

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| **Petroleum Geology team project** |

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| **2017-2018** |

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| **(Projet collectif Géologie Pétrolière)Department: G.E.O.S.** |  |
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| **Coordinator: J.BAILLEUL** |

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| **Teaching method: Common core** |

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| **Distribution of teaching methods:** |
| **CM** | **EXA** | **TD** | **TP** | **AFP** | **AFNP** | **CC** | **EXT** | **TTE** |
| **0h** | **2h** |  **0h** |  **2h** |  **96h** | **0h** | **0h** |  **42h** |  **70h** |

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| **ECTS credits:12** |

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|  | **Key:** CM = Lecture, EXA = Exam, TD = Tutorial, TP = Practical work, AFP = Scheduled self-study, AFNP = Unscheduled self-study, CC = Ongoing assessment, EXT = Curriculum related excursion, TTE = Homework |
| **Pre-requisites (module title(s)):** | Complete (or have already completed) the relevant specialization program |
| **By the end of the module, students will be able to (objectives):** |
| • Resolve industrial problems,• Present operational solutions,• Manage an entire project,• Organize a team,• Meet targets in terms of resources, results and deadlines.  |
| **Content:** |
| • The collective project is based on resolving often complex industrial problems for the purposes of strategic decision-making.• The topic is set and monitored by the SPEC leader; in some cases it may be carried out in a company or with a company.• It is generally assigned to a small team of students (2 to 6), who are responsible for organizing themselves, distributing tasks, quickly drawing up a schedule and completing the activity for a specified deadline.• Note: The project may sometimes be carried out individually, especially by students having completed a preparatory engineering internship over the previous July and August (this preparatory period is designed to help interns become operational more quickly after their arrival in January). Examples include a literature review, a report on using a software application, monitoring a drilling campaign, etc. The subject of this preparatory internship may be used as a basis for the project. This approach enables the student to remain in contact with the company during semester 9 and serves as a bridge between the preparatory internship and the engineering internship.SPEC Petroleum Geology:• A field school for seismic acquisition, processing and interpretation provides support for one of the proposed projects (in collaboration with the Villefranche Oceanographic Laboratory and INSU-CNRS, on board the Téthys II, and an exploration project of the North-Ligurian rifted margin including evaluation of seabed risks).A second project involves an integrated case study using Petrel (geomodeling): PTV project – play analysis/assessment and prospect evaluation (application of the petroleum exploration workflow from the basin summary to calculations of volumes and risks on IBA data). |
| **Teaching staff:** | J.BAILLEUL, Y.VAUTIER, B.CARLIER, E.INTERVENANT, B.CLAUSSMANN, E.BESSE, E.SAILLET-POURRET, R.TOULLEC |
| **Assessment (procedures and weightings):** |
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| Number of assessments | Procedures | Length of assessment | Weighting of each assessment | Assessment title |
| Assessment 1 | Oral | 0h | 50% | Oral defense of PTV project (Petrel) |
| Assessment 2 | Report | 0h | 50% | Villefranche project report |

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# **French as Foreign Language**

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| **Geosciences** **French as a Foreign Language 1** | **2018-2019** |
| **Faculty: Dr. Martine REY et al.** | **Module:****Beginning French**  | **Time :****24 contact hrs. & interactive assignments****HW: 12 hrs.****Exam: 2 hrs.**  | **2 ECTS credits****1 US credit** |
| **Numerus clausus : 20** |
| **Prerequisite:** none |
| **Objective:** Students will acquire the basic skills to use French in everyday situations  |
| **Description:**. This language course aims at providing students with the necessary language tools to interact successfully in a variety of situations and settings, for example at a farmers’ market or while traveling. Students will continue to learn French outside the classroom by practicing their acquired skills and adding new ones, for example by reading product labels in French, or asking questions during campus events, at a restaurant or in local businesses.. Interactive assignments will therefore complement classroom instruction. Students will be expected to participate actively, using the language skills they are learning inside and outside the classroom.**Course content** :* Basics of French language; “*when in France*” – culturally appropriate does and don’ts
* Describe, narrate, and ask/answer questions in the foreign language in the present time about a variety of topics related to family, daily activities, eating, and traveling.
* Comprehend the foreign language with sufficient ability to grasp the main idea in short conversations pertaining to the topics mentioned above.
* Read and understand the main idea and some details of materials related to daily life and travel (maps, classified ads,)
* Write sentences and short paragraphs on familiar topics relating to personal interests and practical needs. (e.g. postcards)

**Course material** includes: * Music (e.g. Nino Ferrer, Charles Aznavour)
* Food art
* Excerpts from French literature (e.g Emile Zola, *Le Ventre de Paris*)
* Films & video (e.g. *After Winter, Spring; Demain (Tomorrow); Nos enfants nous accuserons (Food Beware)*),
* Menus and descriptions of regional French products.
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| **Instructor:**Martine Rey, Associate Professor of Languages and Cultural Studies et al. |
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| **Assessment:**

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| **Assignments:** | **Method:** | **Time limit (for supervised tests):** | **Weighting:** |
| Class participation | Preparation for class and class discussion | N/A | 30% |
| Communication tasks | Interactive, real life assignments using French | N/A | 30% |
| Final Exam |  |  | 40% |

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| **Geosciences** **French as a Foreign Language 2** | **2018-2019** |
| **Faculty: Dr. Martine REY et al.** | **Module:****Intermediate French**  | **Time :****24 contact hrs. & interactive assignments****HW: 12 hrs.****Exam: 2 hrs.**  | **2 ECTS credits****1 US credit** |
| **Numerus clausus : 20** |
| **Prerequisite:** French 102 or equivalent |
| **Objective:** this course is designed for students at an intermediate level. The goal is to consolidate and improve skills previously acquired in French (101/102, or equivalent). |
| **Description:**. This language course allows students to explore French language and culture in a variety of situations and settings. Students will continue to learn French outside the classroom by practicing their acquired skills and adding new ones, for example by actively participating in campus events, or interacting in everyday life. Interactive assignments will therefore complement classroom instruction. Students will review grammar and phonetics to improve their communication skills. Classes are conducted entirely in French.**Course content** :* Speak the foreign language well enough to communicate on a variety of topics important in the foreign language culture that go beyond needed to “survive” in the foreign culture.
* Read and understand the main idea and most details in material about a variety of topics.
* Write longer paragraphs that show more cohesion than at the elementary level.
* Review of the most basic grammar structures

**Course material** includes: * Music (e.g. George Brassens, Nino Ferrer)
* Magazines and newspapers
* Films & video (e.g. *After Winter, Spring; Demain (Tomorrow); Nos enfants nous accuserons (Food Beware)*),
 |
| **Instructor:**Martine Rey, Associate Professor of Languages and Cultural Studies  |
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| **Assessment:**

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| **Assignments:** | **Method:** | **Time limit (for supervised tests):** | **Weighting:** |
| Class participation | Preparation for class and class discussion | N/A | 30% |
| Communication tasks | Interactive, real life assignments using French | N/A | 30% |
| Final Exam | Oral and written exam |  | 40% |

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