Project in Geomechanics

Objectives of Programme's Learning Outcomes

- Implement an engineering approach dealing with a set problem taking into account technical, economic and environmental constraints
    - Understand the stages of an engineering approach
    - Identify and describe the problem to be solved and the functional need (of prospective clients) to be met considering the state of technology
    - Design, evaluate and optimise solutions addressing the problem
    - Implement a chosen solution in the form of a drawing, a schema, a plan, a model, a prototype, software and/or digital model
    - Communicate the approach, results and prospects to a client or a board
    - Identify and acquire the information and skills needed to solve the problem
- Understand the theoretical and methodological fundamentals in science and engineering to solve problems involving these disciplines
    - Identify, describe and explain the basic principles of engineering particularly in their specialising field
    - Understand laboratory techniques: testing, measuring, monitoring protocol, and security
    - Select and rigorously apply knowledge, tools and methods in sciences and engineering to solve problems involving these disciplines
- Understand the fundamentals of project management to carry out a set project, individually or as part of a team
    - Use the principles and tools of planning (time, tasks and resources)
    - Ensure a project is tracked and documented according to its specifications
    - Adapt the approach and achievements taking into account the feedback received
    - Respect deadlines and timescales
- Collaborate, work in a team
    - Interact effectively with other students to carry out collaborative projects.
    - Analyse personal performance within a group
    - Identify and appropriately implement the different ways of working in a group
- Communicate in a structured way - both orally and in writing, in French and English - giving clear, accurate, reasoned information
    - Argue to and persuade customers, teachers and a board both orally and in writing
    - Use several methods of written and graphic communication: text, tables, equations, sketches, maps, graphs, etc.
    - Give an effective oral presentation, using presentation materials appropriately
    - Present analysis or experiment results in laboratory reports
- Demonstrate thoroughness and independence throughout their studies
    - Develop their scientific curiosity and open-mindedness
        - Learn to use various resources made available to inform and train independently

Learning Outcomes of UE

- Describe the geology of the rock mass (visual and microscopic analysis);
- Assess the quality indexes of the rock mass;
- Collect rock samples and prepare the laboratory test specimens;
- Measure petro-physical properties (density, porosity, permeability);
- Identify the constitutive laws and assess the physical and mechanical properties;
- Collaborative work, organisation, communication

Modelling and Construction of Mining-Like Structures

Objectives of Programme's Learning Outcomes

- Imagine, design, carry out and implement projects and solutions to address a complex problem in the fields of geology and mining engineering by integrating needs, contexts and issues (technical, economic, societal, ethical and environmental).
    - Identify complex problems to be solved and formulate the specifications by integrating client needs, contexts and issues (technical, economic, societal, ethical and environmental).
    - Based on experiments in the laboratory, in the field, and of modelling, design one or more projects or solutions addressing the problem raised; evaluate them in light of various parameters listed in the specifications.
    - Implement a selected solution in the form of a drawing, a pattern, a plan, a model, a prototype, software and/or a digital model.
    - Evaluate the approach and results for their adaptation (strength, optimisation and quality).
- Mobilise a structured set of scientific knowledge and skills and specialised techniques in order to carry out geology and mining engineering missions, using their expertise and adaptability.
    - Master and appropriately mobilise knowledge, models, methods and techniques relating to geology, applied mineralogy, applied petrography, hydrogeology and the study of flows underground, applied geophysics, geology with information technology, geostatistics, research and the evaluation of deposits of mineral and energy materials, rock mechanics and rock masses related to mining engineering, planning and exploitation of mineral and energy resources, development of minerals and waste, characterisation, management and treatment of polluted sites, natural hazards and environmental problems.
    - Analyse and model a problem by critically selecting theories and methodological approaches (modelling, calculations), and taking into account multidisciplinary aspects.
    - Assess the validity of models and results in view of the state of science and characteristics of the problem.
- Plan, manage and lead projects in view of their objectives, resources and constraints, ensuring the quality of activities and deliverables.
    - Define and align the project in view of its objectives, resources and constraints.
    - Assess the approach and achievements, regulate them in view of the observations and feedback received.
    - Respect deadlines and timescales
- Work effectively in teams, develop leadership, make decisions in multidisciplinary, multicultural, and international contexts.
    - Contribute to the management and coordination of a team that may be composed of people of different levels and disciplines.
    - Identify skills and resources, and research external expertise if necessary.

    - Make decisions, individually or collectively, taking into account the parameters involved (human, technical, economic, societal, ethical and environmental).
- Communicate and exchange information in a structured way - orally, graphically and in writing, in French and in one or more other languages - scientifically, culturally, technically and interpersonally, by adapting to the intended purpose and the relevant public.
    - Argue to and persuade customers, teachers and a board, both orally and in writing.
    - Select and use the written and oral communication methods and materials adapted to the intended purpose and the relevant public.
    - Use and produce scientific and technical documents (reports, plans, specifications) adapted to the intended purpose and the relevant public.
- Adopt a professional and responsible approach, showing an open and critical mind in an independent professional development process.
    - Show an open and critical mind by bringing to light technical and non-technical issues of analysed problems and proposed solutions.
    - Exploit the different means available in order to inform and train independently.
- Contribute by researching the innovative solution of a problem in engineering sciences.
    - Construct a framework/reference model, formulate hypotheses and innovative solutions from the analysis of scientific literature, particularly in new and emerging disciplines.
    - Design and implement technical analysis, experimental studies and numerical modelling.
    - Collect and analyse data rigorously.
    - Adequately interpret results taking into account the reference framework within which the research was developed.
    - Communicate, in writing and orally, on the approach and its results in highlighting both the scientific criteria of the research conducted and the theoretical and technical innovation potential, as well as possible non-technical issues.

Learning Outcomes of UE

- use analytical and numerical methods to solve the equilibrium equations;
- assess the stress state in virgin rock masses;
- calculate stress and strain fields around underground openings;
- look for shapes, dimensions and support pressures to be used in order to ensure the stability of a cavity depending on the set objective in terms of measurable displacements on the internal wall;
- design the mining engineering workings by a combination of a set of sciences (mechanics of rock masses) and techniques (construction);
- sequence the elementary operations to be implemented in order to realise a structure safely and by complying with environmental constraints; make a chronogram of the operations.

Project Mining Planning and Optimisation

Objectives of Programme's Learning Outcomes

- Imagine, design, carry out and implement projects and solutions to address a complex problem in the fields of geology and mining engineering by integrating needs, contexts and issues (technical, economic, societal, ethical and environmental).
    - Identify complex problems to be solved and formulate the specifications by integrating client needs, contexts and issues (technical, economic, societal, ethical and environmental).
    - Based on experiments in the laboratory, in the field, and of modelling, design one or more projects or solutions addressing the problem raised; evaluate them in light of various parameters listed in the specifications.
    - Implement a selected solution in the form of a drawing, a pattern, a plan, a model, a prototype, software and/or a digital model.
    - Evaluate the approach and results for their adaptation (strength, optimisation and quality).
- Mobilise a structured set of scientific knowledge and skills and specialised techniques in order to carry out geology and mining engineering missions, using their expertise and adaptability.
    - Master and appropriately mobilise knowledge, models, methods and techniques relating to geology, applied mineralogy, applied petrography, hydrogeology and the study of flows underground, applied geophysics, geology with information technology, geostatistics, research and the evaluation of deposits of mineral and energy materials, rock mechanics and rock masses related to mining engineering, planning and exploitation of mineral and energy resources, development of minerals and waste, characterisation, management and treatment of polluted sites, natural hazards and environmental problems.
    - Analyse and model a problem by critically selecting theories and methodological approaches (modelling, calculations), and taking into account multidisciplinary aspects.
    - Identify and discuss possible applications of methods and new and emerging technologies in the fields of mining engineering and geology.
    - Assess the validity of models and results in view of the state of science and characteristics of the problem.
- Plan, manage and lead projects in view of their objectives, resources and constraints, ensuring the quality of activities and deliverables.
    - Define and align the project in view of its objectives, resources and constraints.
    - Assess the approach and achievements, regulate them in view of the observations and feedback received.
    - Respect deadlines and timescales
- Work effectively in teams, develop leadership, make decisions in multidisciplinary, multicultural, and international contexts.
    - Interact effectively with others to carry out common projects in various contexts (multidisciplinary, multicultural, and international).
    - Contribute to the management and coordination of a team that may be composed of people of different levels and disciplines.

    - Identify skills and resources, and research external expertise if necessary.
    - Make decisions, individually or collectively, taking into account the parameters involved (human, technical, economic, societal, ethical and environmental).
- Communicate and exchange information in a structured way - orally, graphically and in writing, in French and in one or more other languages - scientifically, culturally, technically and interpersonally, by adapting to the intended purpose and the relevant public.
    - Argue to and persuade customers, teachers and a board, both orally and in writing.
    - Select and use the written and oral communication methods and materials adapted to the intended purpose and the relevant public.
    - Use and produce scientific and technical documents (reports, plans, specifications) adapted to the intended purpose and the relevant public.
- Adopt a professional and responsible approach, showing an open and critical mind in an independent professional development process.
    - Finalise a realistic career plan in line with the realities in the field and their profile (aspirations, strengths, weaknesses, etc.).
    - Show an open and critical mind by bringing to light technical and non-technical issues of analysed problems and proposed solutions.
    - Exploit the different means available in order to inform and train independently.
- Contribute by researching the innovative solution of a problem in engineering sciences.
    - Design and implement technical analysis, experimental studies and numerical modelling.
    - Collect and analyse data rigorously.
    - Communicate, in writing and orally, on the approach and its results in highlighting both the scientific criteria of the research conducted and the theoretical and technical innovation potential, as well as possible non-technical issues.

Learning Outcomes of UE

- understand the complexity of mining projects;
- synthesize geological data and techniques available;
- build data bases and a geological 3D model;
- dimension and draw the future exploitation;
- choose technical means and infrastructures and performs some simulations to assess the economic feasibility of the project (use of the GEOVIA-SURPAC software). Concerning seminars, apprehend the different facets of the mining engineer job (industry/R&D);