الجمهورية الجزائرية الديمقراطية الشعبية
Democratic and Popular Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research
اللجنة البيداغوجية الوطنية لميدان العلوم والتكنولوجيا
National Educational Committee for the Science and Technology sector

Harmonized Academic Master

National Program

2025- 2026

Establishment	Faculty / Institute	Department
University of Médéa	*Technology*	*Civil Engineering*
Field	Stream	Specialty
Science and Technology	*Civil Engineering*	*Geotechnics*

I – Master's identity card

Access conditions

Sector	Harmonized Master	Licenses giving access to the master's degree	Ranking by license compatibility	Coefficient assigned to the license
Civil engineering	Geotechnics	Civil Engineering	**1**	**1.00**
		Hydraulic	**1**	**1.00**
		Public works	**1**	**1.00**
		Mining	**3**	**0.70**
		Other licenses in the ST domain	**5**	**0.60**

Semester 1   Master : Geotechnics

Educating Unit	Materials / Title	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
				Course	DW	PW			Continuous control	Exam
Fundamental Unit Code : UEF 1.1.1 Credits: 10 Coefficients : 5	Mechanics of continuous medium	4	2	1h30	1h30		45h00	55h00	40%	60%
	Advanced soil mechanics	4	2	1h30	1h30		45h00	55h00	40%	60%
	Geotechnical hazards and risks	2	1	1h30			22h30	27h30		100%
Fundamental Unit Code : UEF 1.1.2 Credits: 10 Coefficients : 5	Slopes and supports	4	2	1h30	1h30		45h00	55h00	40%	60%
	Foundations	4	2	1h30	1h30		45h00	55h00	40%	60%
	Applied geophysics	2	1	1h30			22h30	27h30		100%
Methodological Unit Code : UEM 1.1 Credits: 8 Coefficients : 5	Advanced Programming in Python	2	2	1h30		1h30	45h00	37h30	40%	60%
	Experimental methods	2	1	1h30			22h30	27h30		100%
	Geotechnical testing and site investigation 1	4	2	1h30		1h30	45h00	55h00	40%	60%
Discovery Unit Code: UED 1.1 Credits: 2 Coefficients : 2	Pathology of geotechnical structures	1	1	1h30			22h30	02h30		100%
	Hydrogeology	1	1	1h30			22h30	02h30		100%
Total semestre 1		**30**	**17**	**16h30**	**6h00**	**3h00**	**375h00**	**400h00**		

Semester 2   Master : Geotechnics

Educating Unit	Materials Title	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
				Course	**DW**	**PW**			Continuous control	Exam
Fundamental Unit Code : UEF 1.2.1 Credits: 8 Coefficients : 4	Mechanics of deformable solids	4	2	1h30	1h30		45h00	55h00	40%	60%
	Soil dynamics	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental Unit Code : UEF 1.2.2 Credits: 10 Coefficients : 5	Soil rheology	4	2	1h30	1h30		45h00	55h00	40%	60%
	Geostatistics	4	2	1h30	1h30		45h00	55h00	40%	60%
	Earth dams	2	1	1h30			22h300	27h30		100%
Methodological Unit Code : UEM 1.2 Credits: 9 Coefficients : 5	Finite element methods	5	3	1h30	1h00	1h30	60h00	65h00	40%	60%
	Geotechnical testing and site investigation 2	4	2	1h30		1h30	45h00	55h00	40%	60%
Transversal Unit Code : UET 1.2 Credits: 3 Coefficients : 3	Ethics, professional conduct and intellectual property	1	1	1h30			22h30	02h30		100%
	Elements of Applied AI	2	2	1h30		1h30	45h00	05h00	40%	60%
Total semestre 2		**30**	**17**	**13h30**	**7h00**	**4h30**	**375h00**	**375h00**		

Semester 3   Master : Geotechnics

Educating Unit	Materials / Title	Crédits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
				Course	DW	PW			Continuous control	Exam
Fundamental Unit Code : UEF 2.1.1 Crédits : 8 Coefficients : 4	Dynamics of geotechnical works	4	2	1h30	1h30		45h00	55h00	40%	60%
	Failure calculation and limit analysis	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental Unit Code : UEF 2.1.2 Credits: 10 Coefficients : 5	Rock mechanics	4	2	1h30	1h30		45h00	55h00	40%	60%
	Tunnels and underground works	4	2	1h30	1h30		45h00	55h00	40%	60%
	Road geotechnics	2	1	1h30			22h30	27h30		100%
Methodological Unit Code : UEM 2.1 Credits: 9 Coefficients : 5	Soil improvement	4	2	1h30		1h30	45h00	55h00	40%	60%
	Modeling of geotechnical works	2	1			1h30	22h30	27h30	100%	
	Geographic Information Systems	3	2	1h30		1h00	37h30	37h30	40%	60%
TransversalUnit Code : UET 2.1 Credits: 3 Coefficients : 3	Documentary Research and Thesis Design	1	1	1h30			22h30	02h30		100%
	Reverse Engineering	2	2	1h30		1h30	45h00	05h00	40%	60%
Total semestre		**30**	**17**	**15h00**	**6h00**	**4h00**	**375h00**	**375h00**		

Semester 4

Internship in a company or a research laboratory, assessed through a report and an oral defense.

This table is given as indicative.

	VHS	Coeff	Credits
Personal Work	550	09	18
Internship in a Company or Laboratory	100	04	06
Seminars	50	02	03
Other (Supervision)	50	02	03
Total Semester 4	750	17	30

Master Final Project Evaluation

- Scientific Value (Jury Assessment) – /6
- Thesis Writing (Jury Assessment) – /4
- Presentation and Response to Questions (Jury Assessment) – /4
- Supervisor's Assessment – /3
- Internship Report Presentation (Jury Assessment) – /3

<u>Detailed Program by Subject for Semester 1 (S1)</u>

Semester: 1
Teaching Unit: UEF 1.1.1
Subject 1: Continuum Mechanics Contact
Hours: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Weighting: 2

Course Objectives:

This course aims to introduce students to the theoretical concepts of continuum mechanics.

Recommended Prior Knowledge:

Algebra, Thermodynamics, Rational Mechanics, Fluid Mechanics, Strength of Materials.

Course Content:

Chapter 1. General Concepts (1 Week)
Chapter 2. Mathematical Preliminaries (2 Weeks)
Chapter 3. Stress State Theory (4 Weeks)
Chapter 4. Strain State Theory (4 Weeks)
Chapter 5. Constitutive Relationships (4 Weeks)

Assessment Method
Continuous assessment: 40%; Examination: 60%

1. *P*. Germain. **Mécanique des milieux continus**. Ed. Masson.
2. P. Germain, P. Muller. **Introduction à la mécanique des milieux continus**. Ed. Masson.
3. J. Salençon. **Mécanique des milieux continus, Tomes 1, 2 et 3**. Ed. Ecole Polytechnique, France.
4. J. Coirier, C. Nadot-Martin. **Mécanique des milieux continus**.Ed.Dunod.
5. G. Duvaut. **Mécanique des milieux continus**. Ed. Masson.
6. J. Botsis, M. Deville. **Mécanique des milieux continus**. Ed. Eyrolles.
7. R. Temam, A. Miranville. **Modélisation mathématique et mécanique des milieux continus**. Ed. Springer.

Semester: 1
Course Unit: UEF 1.1.1
Subject 2: Advanced Soil Mechanics
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to provide students with in-depth theoretical and experimental knowledge of the mechanical behavior of granular and fine-grained soils in saturated and unsaturated states.

Recommended prior knowledge:

Soil Mechanics 1 and 2

Course content:

Chapter 1: Review of Coarse and Fine Soils (3 Weeks)

Chapter 2: Behavior of Granular Materials (4 Weeks)

Chapter 3: Fine-grained Soil Behavior (4 Weeks)

Chapter 4: Unsaturated Soil Behavior (4 Weeks)
Assessment Method:

Continuous assessment: 40%; Examination: 60%

Semester: 1
Course Unit: UEF 1.1.1
Subject: Geotechnical Hazards and Risks
Hours: 22.5 hours (Lectures: 1.5 hours)
Credits: 2
Weighting: 1

Learning Objectives:

This course aims to introduce students to the understanding, analysis, and assessment of certain geotechnical risks in order to better manage crisis situations and make appropriate decisions.

Recommended Prior Knowledge:

Knowledge of probability and statistics, and MDS (Method of Determining Seismic Conditions).

Course Content:

Chapter 1. Introduction to Geotechnical Risks (1 Week)
Chapter 2. General Methodology for Risk Analysis (4 Weeks)
Chapter 3. Remote Sensing Applied to the Natural Environment (4 Weeks)
Chapter 4. Methodology for Data Analysis and Processing (4 Weeks)
Chapter 5. Early Warning and Crisis Management Systems (2 Weeks)

Proposed Course Content:

Chapter 1. Introduction to Geotechnical Risks (1 Week)
Chapter 2. Analysis of Different Geotechnical Risks (3 Weeks)
Chapter 3. General Methodology for Risk Analysis (3 Weeks)
Chapter 4. Remote Sensing Applied to the Natural Environment (3 Weeks)
Chapter 5. Methodology for Data Analysis and Processing (3 Weeks)
Chapter 6. Early Warning and Crisis Management Systems (2 Weeks) Weeks)

Assessment Method:

Exam: 100%

Bibliographical References:

1. M. Merad. Decision Support and Expertise in Risk Management. Lavoisier Publishing.

2. J.P. Louisot. Risk Management and Strategy. AFNOR Publishing.

3. J.L. Wybo. Risk Management and Crisis Prevention. Lavoisier Publishing.

4. Techniques and Methods: Shrinkage and Swelling: Analysis and Treatment of Damage Caused by Drought. Guide 3, IFSTTAR Publishing, July 2017.

5. Federal Roads Office (FEDRO): Risk Analysis for National Road Tunnels. ASTRA Publishing; 2014.

6. Kergomard C.: Aerospace Remote Sensing: An Introduction. Course at the École Nationale Supérieure de Paris.

7- AFTES Recommendations: Characterization of geological, hydrogeological, and geotechnical uncertainties and risks. GT32R2F1, July–August 2012.

8- Methodological Guide: Risk Management in Major Public Infrastructure Projects. Publisher: Infrastructure Québec.

9- Techniques de l'Ingénieur: Special Issue "Safety and Risk Management." (www.techniques-ingénieur.fr/traite/securite_et_gestion_des_risques/T1112)
Envoyer des commentaires
Panneaux latéraux
Historique
Enregistrées

Semester: 1
Course Unit: UEF 1.1.2
Subject 1: Slopes and Retaining Structures
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to deepen students' knowledge of slope stability analysis and the design and calculation of retaining structures.

Recommended Prior Knowledge:

Soil Mechanics 1 and 2, Foundations and Geotechnical Structures

Course Content:

- Part 1: Slope and Embankment Stability

Chapter 1. Plane Failure Slope Stability (2 Weeks)
Chapter 2. Circular Failure Slope Stability (3 Weeks)
Chapter 3. General Failure Slope Stability (3 Weeks)

- Part Two: Retaining Structures

Chapter 4. Classification of Retaining Structures (1 Week)
Chapter 5. Actions and Stresses (3 Weeks)
Chapter 6. Design and Justification (3 Weeks)

Assessment Method:

Continuous Assessment: 40%; Examination: 60%

Bibliographical References:

1. F. Schlosser. Eléments de mécanique des sols. Ed. Presses des ponts, France.
2. F. Schlosser. Exercices de mécanique des sols. Ed. Presses des ponts, France.
3. J. Costet, G. Sanglerat. Cours pratique de mécanique des sols. Tomes 1 & 2. Ed. Dunod.
4. G. Sanglerat, G. Olivari, B. Cambou. Problèmes pratiques de mécanique des sols et de fondations. Tomes 1 & 2. Ed. Dunod.
5. G. Philipponnat, B. Hubert. Fondations et ouvrages en terre. Ed. Eyrolles.
6. J.L. Durville, G. Sève.Stabilité des pentes : glissements en terrain meuble (C254). Ed. Techniques de l'ingénieur.
F. Schlosser.Ouvrages de soutènement : poussées et butées (C242). Ed. Techniques de l'ingénieur.

Semester: 1
Course Unit: UEF 1.1.2
Subject 2: Foundations
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4Weighting: 2

Learning Objectives:

This course aims to deepen students' knowledge of the design and calculation of shallow and deep foundations for structures.

Recommended Prior Knowledge:
Soil Mechanics 1 and 2, Foundations and Geotechnical Structures

Course Content:

Chapter 1. Typical Actions and Design Loads (2 Weeks)
Chapter 2. Shallow Foundations (5 Weeks)
Chapter 3. Deep Foundations (5 Weeks)
Chapter 4. Special Foundations (3 Weeks)

Assessment Method:

Continuous Assessment: 40% Exam: 60%

Bibliographical references:
1. F. Schlosser. Eléments de mécanique des sols. Ed. Presses des ponts, France.
2. F. Schlosser. Exercices de mécanique des sols. Ed. Presses des ponts, France.
3. J. Costet, G. Sanglerat. Cours pratique de mécanique des sols. Tomes 1 & 2. Ed. Dunod.
4. G. Sanglerat, G. Olivari, B. Cambou. Problèmes pratiques de mécanique des sols et de fondations. Tomes 1 & 2. Ed. Dunod
5. G. Philipponnat, B. Hubert. Fondations et ouvrages en terre. Ed. Eyrolles.
6. R. Frank. Fondations superficielles (C246). Ed. Techniques de l'ingénieur.
7. R. Frank. Fondations profondes (C248). Ed. Techniques de l'ingénieur.
8. R. Frank. Fondations superficielles et profondes. Ed. Presses des ponts.
9. P. Bousquet. Pieux et palplanches (C140). Ed. Techniques de l'ingénieur.
Robert D. Holtz, William D. Kovacs.Introduction à la géotechnique. Ed.Ecole Polytechnique de Montréal, Canada

Semester: 1
Course Unit: UEM 1.1.2
Subject 3: Applied Geophysics
Hours: 22.5 (Lectures: 1.5 hours)
Credits: 2
Weighting: 1

Learning Objectives:

This course aims to introduce students to the theoretical and experimental concepts of applied geophysics in civil engineering.

Recommended Prerequisites:

Soil Mechanics 1 and 2, Continuum Mechanics.

Course Content:

Chapter 1. Generalities on Geophysics and its Applications (3 Weeks)

(Geophysics and Geotechnical Investigation, Measured Physical Parameters, Geophysical Prospecting Methods, Advantages and Disadvantages)
Chapter 2. Gravimetric and Microgravimetric Methods (3 Weeks)
Chapter 3. Electrical Methods (3 Weeks)
Chapter 4. Seismic Methods (3 Weeks)
Chapter 5. Electromagnetic Methods (3 Weeks)

Practical Session Schedule (depending on the availability of test benches specific to geophysical investigation)

Assessment Method:

Exam: 100%

Bibliography:

1. . Dubois, M. Diament, J.P. Cogné. Géophysique. Ed. Dunod.
2. L. Lliboutry. Géophysique et géologie. Ed. Elsevier-Masson.
3. R. Lagabrielle. Géophysique appliquée au génie civil (C224). Ed. Techniques de l'ingénieur, France.
4. M. Chouteau, B. Giroux. Géophysique appliquée II (GLQ 3202) : méthodes électriques (notes de cours). Ed. Ecole polytechnique de Montréal, Canada.
5. H. Shout, M. Djeddi. Bases physiques de la prospection sismique. Ed. OPU, Algérie.

> *Semester: S1*
> *Course Unit: UEM 1.1.1*
> *Subject: Advanced Programming in Python*
> *Hours: 45 (Lectures 1.5 hours, Practical Sessions 1.5 hours)*
> *Credits: 2*
> *Weighting: 2*

Course Objectives:
Learning Skills:

- Use of computer tools for the acquisition, processing, production, and dissemination of information
- Skills in Python and project management
- Skills in data automation and visualization

Objectives:
- To deepen mastery of the Python language and introduce students to the fundamentals of data analysis and artificial intelligence
- To acquire a solid foundation in computer science
- Learn to program in Python and Excel
- Master task automation
- Master project management software
Required materials:

- A computer with Python installed,
- Python libraries: NumPy, Pandas, Scikit-learn, Matplotlib, os.listdir, os.path.exists, os.mkdir, os.rmdir, Matplotlib, Seaborn, Plitly, Request, Beautiful Soup, Tkinter, PyQT, …
- TensorFlow, PyTorch, …

Prerequisites: Python programming
Course content:
Chapter 1: Python Programming Review (2 Weeks)

Chapter 2: Programming and Automation (4 weeks)

Chapter 3: Advanced Excel (2 weeks)

Chapter 4: GanttProject (2 weeks)
•
Chapter 5: Advanced Object-Oriented Programming (3 weeks)
1

Assessment method:

Exam 60%, Continuous Assessment 40%
Bibliograph

Practical Exercises:

Practical Exercise 1: Mastering the Basics of Python Programming

(Control Structures, Types, Loops, Simple Functions)
1. Introduction
2. Reading and Processing Text Files
3. Managing Simple Reports (PDF, Excel)

Practical Exercise 2:

- Develop specifications for a mini-project to automate tasks using Python, consisting of automatically identifying and sending reports by email:
1.
Lab 3:

1. Programming the Excel dashboard seen in the tutorial
2. Creating automated Excel spreadsheets
3. Simple macros
4. Conditional formulas
5. VLOOKUP

Lab 4:
Organizing a meeting using a Gantt chart
1. Create a new project:
5. Creating the Gantt chart:
• Visualize the agenda
• Identify key items
6. Track progress in real time (projection of the Gantt chart)
Lab 5: Advanced Structures and Code Organization

(Custom functions, dictionaries, modules, and modular organization)
Lab 6: Advanced Object-Oriented Programming in Python

(Encapsulation, inheritance, special methods, simple design patterns)
Lab 7: File Manipulation and Data Analysis

(Reading/writing files, text processing, introduction to Pandas and NumPy)
Lab 8: Data Preparation and Processing for Artificial Intelligence

(Loading AI datasets, cleaning, transformation, feature selection)

Final Project
Title: Analysis and Visualization of a Dataset + Simple Predictive Model
Skills Used: Data reading, object-oriented programming, advanced structures, Pandas, Scikit-learn.
(Oral presentation + written report).
Assessment method:
Exam 60%, Continuous Assessment 40

[1] . E.Schultz et M.Bussonnier (2020) : Python pour les SHS. Introduction à la programmation de données. Presses Universitaires de Rennes.

[2] . C.Paroissin, (2021) : Pratique de la data science avec R : arranger, visualiser, analyser et présenter des données. Paris : Ellipses, DL 2021.

[3] . S.Balech et C.Benavent : NLP texte minig V4.0, (Paris Dauphine – 12/2019) : lien : https://www.researchgate.net/publication/337744581_NLP_text_mining_V40_-_une_introduction_-_cours_programme_doctoral

[4] . Allen B. Downey Think Python: How to Think Like a Computer Scientist, O'Reilly Media, 2015;

[5] . Ramalho, L.. Fluent Python. " O'Reilly Media, Inc.", 2022;

[6] . Swinnen, G.. Apprendre à programmer avec Python 3. Editions Eyrolles, 2012;

[7] . Matthes, E. Python crash course: A hands-on, project-based introduction to programming. no starch press, 2019

[8] . Cyrille, H. (2018). Apprendre à programmer avec Python 3. Eyrolles, 6ème édition. ISBN: 978-2212675214

[9] . Daniel, I. (2024). Apprendre à coder en Python, J'ai lu

[10] . Nicolas, B. (2024). Python, du grand débutant à la programmation objet Cours et exercices corrigés, 3eme édition, Ellipses

[11] . Ludivine, C. (2024). Selenium Maîtrisez vos tests fonctionnels avec Python, Eni

Ressources en ligne :
- Documentation officielle Python : docs.python.org
- Exercices Python sur Codecademy : codecademy.com/learn/learn-python-3
- W3Schools Python Tutorial : w3schools.com/python/

Semester: 1
Course Unit: UEM1.1
Subject 2: Experimental Methods
Hours: 22.5 (Lectures: 1.5 hours)
Credits: 2
Weighting: 1

Learning Objectives:
This course provides students with knowledge of the latest developments in current soil mechanics testing, primarily in the laboratory and also in the field.
Recommended Prior Knowledge:
Soil Mechanics 1 and 2.
Course Content:
Chapter 1: Testing Standards: experimental procedures and techniques for analyzing test results (in-situ and laboratory tests). (3 weeks)
Chapter 2: Permeability Tests (3 weeks)
Chapter 3: Shear Strength and Triaxial Shear Tests (3 weeks)
Chapter 4: Settlement Calculations and Oedometer Tests (3 weeks)
Chapter 5: In-Situ Tests (3 weeks)

Assessment Method:
Exam: 100%

References:
All soil mechanics textbooks

Semester: 1
Course Unit: UEM 1.1
Subject 3: Geotechnical Testing and Site Investigation 1
Hours: 45 (Lectures 1.5 hours and Practical Sessions 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to introduce students to the different types of in-situ and laboratory tests used in soil mechanics.

Recommended prior knowledge:

Soil Mechanics 1 and 2

Course content:

- Soundings and sampling
- In-situ testing (Part 1)
- Laboratory testing (Part 1)

Note: The instructor has the freedom to schedule the various types of in-situ and laboratory tests available at their institution, in addition to those already completed in the first cycle (Bachelor's degree). These tests must be divided into two semesters: Semester 1 (for Part 1) and Semester 2 (for Part 2).

Course Content Proposal

I- Soundings and Boreholes (definition, characteristics, core drilling, coring techniques, borehole density, investigation depth) 2 weeks
II- Sampling and Geotechnical Characteristics 2 weeks
III- Mechanical Tests (driving tests, static penetration tests, piezocone, pressuremeter tests, vane shear tests) 2 weeks
IV- Destructive Drilling (instantaneous and delayed well logging) 1 week
V- Instruments and Structure Monitoring 2 weeks
VI- Geotechnical Study (geotechnical engineer's role, preliminary investigation, the different phases and program of the geotechnical study) 2 weeks
VII- Variability and Uncertainties (heterogeneity, soil variability, measurement uncertainties) 2 weeks
VIII- Selection of Investigation Techniques 2 weeks

Assessment Method:

Continuous Assessment: 40%; Final Exam: 60%

Bibliographical references:

1. M. Cassan (1988), Les essais in situ en mécaniques des sols1. Réalisation et interprétation. Edition Eyrolles.

2. M. Rat, (1974), Reconnaissance des sols.Techniques de l'ingénieur, Ref C224 V1.

3. P. Reiffsteck, D. Lossy, J. Benoît, (2012), Forages, sondages et essais in situ géotechniques : Les outils pour la reconnaissance des sols et des roches. Editeur : Presses Des Ponts.

4. P. Reiffsteck, M. Zerhouni, J.-L. Averlan (2018), Essais de laboratoire pour la mécanique des sols et la géotechnique : les outils pour la reconnaissance des sols et des roches. Presses de l'Ecole nationale des ponts et chaussées.

5. Roy E. Hunt (2005),Geotechnical investigation methods : afield guide for geotechnicalengineers. CRC Press LLC, 2005.

6. Keith Lawrence H. (1992), Environmental sampling and analysis : A pratical guide, Lewis Publisher, Chelsea, Michigan.

7. Recommandations de l'AFTES, (2012)Caractérisation des incertitudes et des risques géologiques, hydrogéologiques et géotechniques.(GT32 R2 F1), 2012.

8. G. Philipponnat, B. Hubert, (1998),Fondations et ouvrages en terre. Edition Eyrolles.

9. H. Cambefort (1972) ,Géotechnique de l'ingénieur et reconnaissance des sols. Edition Eyrolles.

10. Union syndicale géotechnique – Missions géotechniques types (Projet de Normalisation), 1996.

11. Martin Van Staveren (2006),Uncertainty and ground conditions : A risk management approach.Elsevier.

Detailed program by subject for semester S2

semester: 2
Course Unit: UEF 1.2.1
Subject 1: Mechanics of Deformable Solids
Hours: 67.5 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to introduce students to the theoretical and experimental concepts of deformable solid mechanics.

Recommended Prior Knowledge:

Rational Mechanics, Thermodynamics, Continuum Mechanics.

Course Content:

Chapter 1. Physical Mechanisms of Deformation and Fracture (2 Weeks)
Chapter 2. Rheological Classification and Experimental Characterization (3 Weeks)
Chapter 3. Elasticity and Viscoelasticity (5 Weeks)
Chapter 4. Plasticity and Viscoplasticity (5 Weeks)

Assessment Method:

Continuous Assessment: 40%; Final Examination: 60%

References:

1. J. Lemaitre, J.L. Chaboche. Mécanique des solides déformables et endommageables. Ed. Dunod.
2. J. Lemaitre, J.L. Chaboche, A. Benallal, R. Desmorat. Mécanique des matériaux solides. Ed. Dunod.
3. D. François, A. Pineau, A. Zaoui. Elasticité et plasticité. Ed. Lavoisier.
4. S. Timoshenko, J.M. Goodier. Théorie de l'élasticité. Ed. Librairie Polytechnique Ch. Béranger.
5. J. Salençon. Elastoplasticité. Ed. Ecole polytechnique, France.
6. B. Halphen, J. Salençon. Elasto-plasticité. Ed. Presses desponts, France.
7. V.A. Lubarda. Elastoplasticity theory. Ed. CRC Press.
8. R. Richards Jr. Principles of solid mechanics. Ed. CRC Press.
Robert J. Asaro, Vlado A. Lubarda. Mechanics of solid and materials. Ed. Cambridge UniversityPress

Semester: 2
Course Unit: UEF 1.2.1
Subject 2: Soil Dynamics
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to introduce students to the dynamic calculations of soils and foundations of geotechnical structures.

Recommended Prior Knowledge:

Waves and Vibrations, Soil Mechanics 1 and 2, Foundations and Geotechnical Structures, Continuum Mechanics.

Course Content:

Chapter 1. Characterization of Seismic Motion (3 Weeks)

(Elements of seismology, propagation of seismic waves in soils, concepts of polarization, historical seismicity of Algeria)
Chapter 2. Soil Behavior Under Cyclic Loading (3 Weeks)
Chapter 3. Measurement of the Dynamic Characteristics of Soils (3 Weeks)
Chapter 4. Seismic Response of a Soil Profile (3 Weeks)
Chapter 5. Soil Liquefaction (3 Weeks)

Assessment Method:

Continuous Assessment: 40%; Final Exam: 60%

References:
1. . Bouafia. Introduction à la dynamique des sols. Tomes 1 & 2. Ed. OPU, Algérie.
2. A. Pecker. Dynamique des sols. Ed. Presses des ponts, France.
3. Braja M. Das, G.V. Ramana. Principles of soil dynamics. Ed. Cengage Learning, USA.
4. Braja M. Das. Fundamentals of soil dynamics. Ed. Elsevier.
5. Shamsher Prakash. Soil dynamics. Ed. Mc-Graw-Hill.
6. A. Verruijt. An introduction to soil dynamics. Ed. Springer.
7. F.E. Richart, J.R. Hall Jr., R.D. Woods. Vibrations of soils and foundations. Ed. Prentice-Hall, USA.
S.L. Kramer. Geotechnical earthquake engineering. Ed. Prentice-Hall, USA

Semester: 2
Course Unit: UEF 1.2.2
Subject 1: Soil Rheology
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to provide students with in-depth theoretical and experimental knowledge of the mechanical behavior of soils under homogeneous loads for the purpose of designing foundations and geotechnical structures.

Recommended Prerequisites:

Soil Mechanics 1 and 2, Continuum Mechanics

Course Content:

Chapter 1. In-situ and Laboratory Behavior (1 Week)

Chapter 2. Elastic Constitutive Laws (4 Weeks)

Chapter 3. Elastoplastic Constitutive Laws (4 Weeks)

Chapter 4. Elasto-Visco-Viscoplastic Constitutive Laws (4 Weeks)

Chapter 5. Constitutive Laws and Numerical Solution (2 Weeks)

Assessment Method:

Continuous Assessment: 40%; Examination: 60%

References:

1. P. Magnan, P. Mestat. Loi de comportement et modélisation des sols (C218). Ed. Techniques de l'ingénieur.
2. P. Mestat. De la rhéologie des sols à la modélisation des ouvrages. Ed. IFSTTAR (ex LCPC), France.
3. Braja M. Das. Advanced soil mechanics. Ed. Taylor & Francis Group.
4. Sergei S. Vyalov. Rheological fundamentals of soils mechanics. Ed. Elsevier.
5. M.J. Keedwell. Rheology and soil mechanics. Ed. Elsevier.
6. D. Muir Wood. Geotechnical modelling. Ed. CRC Press.

Semester: 2
Course Unit: UEF 1.2.2
Subject 2: Geostatistics
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to introduce students to the theoretical concepts of statistical calculation applied to geotechnics.

Recommended Prior Knowledge:

Statistics, Soil Mechanics

Course Content:

Chapter 1. Theoretical Foundations of Geostatistics (3 Weeks)

(Random Functions, Stationarity, Covariance, Fitting a Theoretical Structure Function)
Chapter 2. Variogram Analysis (4 Weeks)
Chapter 3. Kriging Theory (4 Weeks)
Chapter 4. Software and Applications (4 Weeks)

Assessment Method:

Continuous Assessment: 40%; Final Exam: 60%

References:

1. J.P.Chilès, P. Delfiner. Geostatistics: Modeling Spatial Uncertainty. Second Edition. Ed. Wiley, 2012.
2. C. Lantuéjoul. Geostatistical simulation: Models and Algorithms. Ed. Springer, 2002.
3. H. Wackernagel. Multivariate geostatistics : an introduction with applications. Ed. Springer, 2003.
4. R. Webster, M. Olivier. Geostatistics for environmental scientists. Statistics in Practice. Ed. Wiley, 2001.
5. N. Cressie. Statistics for Spatial Data. Revised Edition. Ed. Wiley, 2015

Semester: 2
Course Unit: UEF 1.2.2
Subject 3: Earth Dams
Hours: 22.5 (Lectures: 1.5 hours)
Credits: 2
Weighting: 1

Learning Objectives:

This course aims to introduce students to the design and calculation of earth dams.

Recommended Prior Knowledge:

Advanced Soil Mechanics, Foundations, Slopes and Retaining Walls, Finite Difference Method, Finite Element Method.

Course Content:

Chapter I: Earth Dam Design (4 weeks)
Chapter II: Infiltration Study in an Earth Dam (4 weeks)
Chapter III: Infiltration Control in an Earth Dam (4 weeks)
Chapter IV: Earth Dam Stability (3 weeks)

Assessment Method:

Exam: 100%

Bibliographical References:
1. A.J. Schleiss, H. Pougatsch. Les barrages – Du projet à la mise en service. Ed. Presses polytechniques et universitaires romandes.
2. P. Le Delliou. Les barrages : conception et maintenance. Presses universitaires de Lyon, France.
3. L. Vulliet, L. Laloui, J. Zhao. Mécanique des sols et des roches. Ed. Presses polytechniques et universitaires romandes.

Semester: 2
Course Unit: UEM 1.2
Subject 1: Finite Element Method
Hours: 60 (Lectures: 1.5 hours, Tutorials: 1 hour, Practical Sessions: 1.5 hours)
Credits: 5
Weighting: 3

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Learning Objectives:

This course aims to introduce students to the calculation of geotechnical structures using the finite element method.

Recommended prior knowledge:

Mathematical analysis, Matrix calculus, Strength of materials, Numerical methods, Soil mechanics 1 and 2.

Course content:

Chapter 1. General principles (3 weeks)
Chapter 2. 1D finite element method (4 weeks)
Chapter 3. 2D finite element method (4 weeks)
Chapter 4. 3D finite element method (4 weeks)

Assessment method:
Continuous assessment: 40%; Examination: 60%
Bibliographical references:

1. G. Dhatt. G. Touzot, E. Lefrançois. Méthode des éléments finis. Ed. Hermès-Lavoisier.
2. J. Chaskalovic. Méthode des éléments finis pour les sciences de l'ingénieur. Ed. Lavoisier.
3. J.C. Craveur. Modélisation par éléments finis. Ed. Dunod.
4. M. Bonnet, A. Frangi. Analyse des solides déformables par la méthode des éléments finis. Ed. Ecole polytechnique, France.
5. F. Frey, J. Jirousek. Méthode des éléments finis. Ed. Eyrolles.

Semester: 2
Course Unit: UEM 1.2
Subject 2: Geotechnical Testing and Site Investigation 2
Hours: 45 (Lectures: 1.5 hours, Practical Sessions: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to introduce students to the different types of in-situ and laboratory tests used in soil mechanics.

Recommended prior knowledge:

Soil Mechanics 1 and 2

Course content:

- Soundings and sampling
- In-situ tests (Part 2)
- Laboratory tests (Part 2)

Note: The instructor has the freedom to schedule the various types of in-situ and laboratory tests available at their institution, in addition to those already completed in the first cycle (Bachelor's degree). These tests must be divided into two semesters: Semester 1 (for Part 1) and Semester 2 (for Part 2).

Assessment methods:

Continuous assessment: 40%; Final exam: 60%

References:

All textbooks on soil mechanics

Semester: 2
Course Unit: UET 1.2
Subject: Respect for Ethical Standards and Rules of Integrity
Time: 10:30 PM (Lecture: 1.5 hours)
Credits: 1
Weighting: 1

Course Objectives:

To develop students' awareness of the ethical principles and rules governing life at university and in the workplace. To raise their awareness of the respect and value of intellectual property. To explain the risks of moral failings such as corruption and how to combat them, and to alert them to the ethical issues raised by new technologies and sustainable development.

Recommended prior knowledge:

Ethics and professional conduct (the foundations)

Course content:

A. Respect for ethical and integrity rules,

B- Intellectual Property

I
C. Ethics, Sustainable Development, and New Technologies

Assessment method:
Exam: 100%

Bibliographical references:

1. Charte d'éthique et de déontologie universitaires, https://www.mesrs.dz/documents/12221/26200/Charte+fran__ais+d__f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Arrêtés N°933 du 28 Juillet 2016 fixant les règles relatives à la prévention et la lutte contre le plagiat
3. L'abc du droit d'auteur, organisation des nations unies pour l'éducation, la science et la culture(UNESCO)
4. E. Prairat, De la déontologie enseignante. Paris, PUF, 2009.
5. Racine L., Legault G. A., Bégin, L., Éthique et ingénierie, Montréal, McGraw Hill, 1991.
6. Siroux, D., Déontologie : Dictionnaire d'éthique et de philosophie morale, Paris, Quadrige, 2004, p. 474-477.
7. Medina Y., La déontologie, ce qui va changer dans l'entreprise, éditions d'Organisation, 2003.
8. Didier Ch., Penser l'éthique des ingénieurs, Presses Universitaires de France, 2008.

9. Gavarini L. et Ottavi D., Éditorial. de l'éthique professionnelle en formation et en recherche, Recherche et formation, 52 | 2006, 5-11.
10. Caré C., Morale, éthique, déontologie. Administration et éducation, 2e trimestre 2002, n°94.
11. Jacquet-Francillon, François. Notion : déontologie professionnelle. Letélémaque, mai 2000, n° 17
12. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.
13. Galloux, J.C., Droit de la propriété industrielle. Dalloz 2003.
14. Wagret F. et J-M., Brevet d'invention, marques et propriété industrielle. PUF 2001
15. Dekermadec, Y., Innover grâce au brevet: une révolution avec internet. Insep 1999
16. AEUTBM. L'ingénieur au cœur de l'innovation. Université de technologie Belfort-Montbéliard
17. Fanny Rinck etléda Mansour, littératie à l'ère du numérique : le copier-coller chez les étudiants, Université grenoble 3 et Université paris-Ouest Nanterre la défense Nanterre, France
18. Didier DUGUEST IEMN, Citer ses sources, IAE Nantes 2008
19. Les logiciels de détection de similitudes : une solution au plagiat électronique? Rapport du Groupe de travail sur le plagiat électronique présenté au Sous-comité sur la pédagogie et les TIC de la CREPUQ
20. EmanuelaChiriac, Monique Filiatrault et André Régimbald, Guide de l'étudiant: l'intégrité intellectuelle plagiat, tricherie et fraude… les éviter et, surtout, comment bien citer ses sources, 2014.
21. Publication de l'université de Montréal, Stratégies de prévention du plagiat, Intégrité, fraude et plagiat, 2010.
22. Pierrick Malissard, La propriété intellectuelle : origine et évolution, 2010.
23. Le site de l'Organisation Mondiale de la Propriété Intellectuelle www.wipo.int
http://www.app.asso.fr/

Semester: S2
Course Unit: 1.2.2
Subject: Elements of Applied Artificial Intelligence
Hours: 45 (Lectures 1.5 hours, Practical Sessions 1.5 hours)
Credits: 2
Weighting: 2

Learning Objectives:

- Identify the opportunities of artificial intelligence in engineering sciences
- Understand the ethical implications of AI and best practices for its use.
- Ability to use AI techniques in problem-solving

Objectives:
- Mastery of AI algorithms
- Introduction to the fundamental concepts, tools, and applications of modern artificial intelligence, with an emphasis on practical application using Python and its libraries.
- Deepen your knowledge of the Python language,

- Understand AI approaches to problem-solving,

Prerequisites:

Advanced Python programming
Required materials:

- A computer with Python installed,
- Python libraries: NumPy, Pandas, Scikit-learn, Matplotlib, os.listdir, os.path.exists, os.mkdir, os.rmdir, Matplotlib, Seaborn, Plitly, Request, Beautiful Soup, Tkinter, PyQT, …
- TensorFlow, PyTorch, …
Course content:
Chapter 1: Introduction to Artificial Intelligence (AI) (1 week)

Chapter 2: Basic Mathematics for AI (1 week)

Chapter 3: Machine Learning (3 weeks)

Chapter 4: Supervised Classification (3 weeks)
5. Exercises:
• Explain how to use Scikit-learn
• Comparison of several models on a dataset
• …

Chapter 6: Neural Networks

Chapter 6: Introduction to Neural Networks
Chapter 7: Mini-project (supervised personal work outside of class):

Creation of a complete classification or clustering model, with preprocessing, training, and visualization; Choose and complete one project from the following (to be distributed at the beginning of the semester):

Practical exercises:
Lab 1: Initialization
Lab 2:
• Implement a simple regression using Scikit-learn and visualize it with Matplotlib (for example)
• Visualize the results with Matplotlib
• …
Lab 3:
• Machine learning pipeline and data separation
• Deepen understanding of the concepts covered in the lecture
Lab 4:
• Using Scikit-learn to train a simple classification model
• …….
Lab 5:
• Implement a clustering algorithm
Envoyer des commentaires
Panneaux latéraux
Historique
Enregistrées
Utilisez les flèches pour afficher la traduction complète.

Bibliography:
Ganascia, J.Gabriel (2024) : l'IA expliquée aux humains. Paris France- Edition le Seuil.

- Anglais, Lise, Dilhac, Antione, Dratwa, Jim et al. (2023) : L'éthique au coeur de l'IA. Quebec Obvia.

- J.Robert (2024) : Natural Language Processing (NLP) : définition et principes – Datasciences. Lien : https://datascientest.com/introduction-au-nlp-natural-language-processing

- Qu'est-ce que le traitement du langage naturel. Lien : https://aws.amazon.com/fr/what-is/nlp/

- M.Journe : Eléments de Mathématiques discrètes – Ellipses

- F.Challet : L'apprentisage profond avec Python – Eyrolles

- H.Bersini (2024) : L'intelligence artificielle en pratique avec Python – Eyrolles

- B.Prieur (2024) : Traitement automatique du langage naturel avec Python – Eyrolles

- V.Mathivet (2024) : Implémentation en Python avec Scikit-learn – Eyrolles

- G.Dubertret (2023) : Initiation à la cryptographie avec Python – Eyrolles

- S.Chazallet (2023) : Python 3 – Les fondamentaux du langage - Eyrolles

- H.Belhadef, I.Djemal : Méthode TALN – Cours de l'unievrsité de Msila - Algérie

Detailed program by subject for semester S3

Semester: 2
Course Unit: UEF 1.2.2
Subject 3: Earth Dams
Hours: 22.5 (Lectures: 1.5 hours)
Credits: 2

Learning Objectives:

This course aims to introduce students to the dynamic calculation of geotechnical structures and their interaction with their environment.

Recommended Prior Knowledge:

Advanced Soil Mechanics, Foundations, Slopes and Retaining Walls, Soil Dynamics.

Course Content:

Chapter 1. General Principles of Soil-Structure Interaction (1 Week)
Chapter 2. Foundation Behavior Under Vibrating Machines (4 Weeks)
Chapter 3. Seismic Bearing Capacity of Foundations (4 Weeks)
Chapter 4. Seismic Stability of Retaining Structures (3 Weeks)
Chapter 5. Seismic Stability of Slopes and Embankments (3 Weeks)

Assessment Method:

Continuous Assessment: 40%; Final Examination: 60%

Bibliographical references:
1. A. Bouafia. Introduction à la dynamique des sols. Tomes 1 & 2. Ed. OPU, Algérie.
2. A. Pecker. Dynamique des sols. Ed. Presses des ponts, France.
3. Braja M. Das, G.V. Ramana. Principles of soil dynamics. Ed. Cengage Learning, USA.
4. Braja M. Das. Fundamentals of soil dynamics. Ed. Elsevier.
5. Shamsher Prakash. Soil dynamics. Ed. Mc-Graw-Hill.
6. S.L. Kramer. Geotechnical earthquake engineering. Ed. Prentice-Hall, USA
7.

Semester: 3
Course Unit: UEF 2.1.1
Subject 2: Structural Analysis and Limit Analysis
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4

Learning Objectives:

This course aims to introduce students to the theoretical concepts of structural analysis and limit analysis.

Recommended Prior Knowledge:

Continuous Mechanics, Deformable Solid Mechanics, Soil Mechanics

Course Content:

Chapter 1. Concept of Limit Loads and Common Failure Criteria (3 Weeks)
Chapter 2. Static Approach from the Inside (3 Weeks)
Chapter 3. Kinematic Approach from the Outside (3 Weeks)
Chapter 4. Practical Applications (6 Weeks)
- Structures (beams, frames, thin plates and slabs)
- Geotechnical Structures (excavation stability, lateral earth pressure, foundation bearing capacity)

Assessment Method:

Continuous Assessment: 40%; Final Exam: 60%

References:

1. . J. Salençon. Calcul à la rupture et analyse limite. Ed. Presses des ponts, France.
2. J. Salençon. Yield design. Ed. Wiley-ISTE.
3. P. De Buhan. Plasticité et calcul à la rupture. Ed. Presses des ponts, France.
4. J. Lemaitre, J.L. Chaboche. Mécanique des solides déformables et endommageables. Ed. Dunod.
5. J. Lemaitre, J.L. Chaboche, A. Benallal, R. Desmorat. Mécanique des matériaux solides. Ed. Dunod.

Semester: 3
Course Unit: UEF 2.1.2
Subject 1: Rock Mechanics
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4

Learning Objectives:

This course aims to introduce students to the theoretical and experimental concepts of rock mechanics as applied to civil engineering structures.

Recommended Prior Knowledge:

Soil Mechanics 1 and 2, Foundations and Geotechnical Structures, Continuum Mechanics.

Course Content:

Chapter 1. Generalities on Rocks and Rock Masses (4 Weeks)

Chapter 2. Mechanical Behavior of Rocks and Rock Masses (6 Weeks)

Chapter 3. Stability of Rock Slopes (3 Weeks)

Chapter 4. Stability of Rock Cavities (2 Weeks)

Assessment method:

Continuous assessment: 40%; Examination: 60%

Bibliographic references:

1. J.L. Durville. Mécanique des roches : Généralités (C350). Ed. Techniques de l'ingénieur.
2. J.L. Durville, H. Héraud. Description des roches et des massifs rocheux (C352). Ed. Techniques de l'ingénieur.
3. P. Duffaut, F. Homand. Manuel de mécanique des roches. Tomes 1 & 2. Ed. Presses des ponts, France.
4. R.E. Goodman. Introduction to rock mechanics. Ed. John Wiley and Sons, New York.
   E. Hoek. Practical Rock engineering. Ed. https://www.rocscience.com

Semester: 3
Course Unit: UEF 2.1.2
Subject 2: Tunnels and Underground Structures
Hours: 45 (Lectures: 1.5 hours, Tutorials: 1.5 hours)
Credits: 4
Weighting: 2
Weighting: 1

Learning Objectives:

This course aims to introduce students to the design and calculation of tunnels and other underground structures.

Recommended Prior Knowledge:

Advanced Soil Mechanics, Deformable Solid Mechanics, Rock Mechanics, Finite Difference Method, Finite Element Method.

Course Content:

Chapter 1. Definition and Classification of Underground Structures (2 Weeks)
Chapter 2. Tunnel Design and Construction Techniques (3 Weeks)
Chapter 3. Tunnel Calculation and Dimensioning Methods (4 Weeks)
Chapter 4. Tunnel Pathology and Reinforcement Techniques (2 Weeks)
Chapter 5. Practical Application (Design of a Road or Rail Tunnel) (4 Weeks)

Assessment Method:

Continuous Assessment: 40%; Final Examination: 60%

Bibliography:

1. M. Panet. Le calcul des tunnels par la méthode convergence-confinement. Ed. Presses des ponts, France.
2. A. Bouvard-Lecouanet, G. Colombet, F. Esteulle. Ouvrages souterrains : conception – réalisation - entretien. Ed. Presses des ponts, France.
3. L. Vulliet, L. Laloui, J. Zhao. Mécanique des sols et des roches. Ed. Presses polytechniques et universitaires romandes.
4. F. Martin. Mécanique des roches et travaux souterrains : cours et exercices corrigés. Ed. BG Ingénieurs Conseils, ENS Cachan, France.

Semester: 3
Course Unit: UEM2.1
Subject 1: Soil Improvement
Hours: 60 (Lectures: 1.5 hours, Practical Sessions: 1.5 hours)
Credits: 4
Weighting: 2

Learning Objectives:

This course aims to enable students to conduct geotechnical studies applied to the design of road and highway pavements.

Recommended Prior Knowledge:

Soil Mechanics

Course Content:

Chapter 1. Soil Classification According to the GTR (1 Week)
Chapter 2. Road Earthworks (2 Weeks)
Chapter 3. Soil Compaction (4 Weeks)
Chapter 4. Soil Bearing Capacity (4 Weeks)
Chapter 5. Design of Flexible and Rigid Pavements (4 Weeks)

Assessment Method:

Exam: 100%

Bibliographical References:

1. LCPC-SETRA. Guide des terrassements routiers : Réalisation des remblais et des couches de forme.Guide technique, France. Ed. IFSTTAR (ex. LCPC), France.
2. R. Coquand. Routes. Ed. Eyrolles.
3. P. Carillo. Conception d'un projet routier. Guide technique. Ed. Eyrolles.

Learning Objectives:

This course aims to introduce students to various soil stabilization and geotechnical structure reinforcement techniques.

Recommended Prior Knowledge:

Soil Mechanics, Geotechnical Testing 1& 2, Road Geotechnics

Course Content:

1. General Principles of Stabilization, Reinforcement, and Repair of Geotechnical Structures

2. Chemical Soil Stabilization (Treatment with Hydraulic Binders)

3. Strengthening of geotechnical structures (Preloading, Retaining walls, Soil nailing, Reinforced earth, Geotextiles, Stone columns, Grouting (jet grouting, soil mixing, etc.), Dynamic compaction).

4. Criteria for selecting methods.

Practical Session Program:

Practical Session 1: Atterberg limits of reinforced soils.

Practical Session 2: Proctor test of reinforced soils.

Practical Session 3: CBR test of reinforced soils.

Practical Session 4: Simple compression test of reinforced soils.

Practical Session 5: Simple box shear test of reinforced soils.

Practical Session 6: Triaxial shear test of reinforced soils.

Practical Session 7: Soil-fiber shear test.

Practical Exercise No. 8: Soil-Geotextile Shear Test

Assessment Method:

Continuous Assessment: 40%; Examination: 60%

Bibliography

1. Bell F. G., (1993): Engineering treatment of soils. E & FN Spon. 302 p.
2. GTS, Guide technique(2000) : « Traitement des sols à la chaux et/ou aux liants hydrauliques. Application à la réalisation des remblais et des couches de forme », LCPC-SETRA (Paris-Bagneux) jan. 2000, 240p.
3. Mouroux P. et Al. (1989) « La construction économique sur les sols gonflants ». Manuels et méthodes, BRGM. France.

4. Routes (2004) ; Le traitement des sols à la chaux et/ou aux liants hydrauliques pour l'exécution des remblais et des couches de forme. Document technique, Routes n°89, Septembre 2004, paris, France.

5. Davidovici, V et Lambert, S. (2013). Fondations et procédés d'amélioration du sol, Guide d'application de l'EC8 parasismique: Dispositions du renforcement du sol par colonnes ballastées en zones sismiques, AFPS (2012). s.l. : Eyrolles, 2013. ISBN: 978-2-212-13831-3.

6. Dhouib, A., Magnan J.P. et Guilloux, A. (2004c). Méthodes de reconnaissance et application aux sols et aux techniques d'amélioration. Actes du Symposium International sur l'Amélioration des Sols en Place (ASEP- GI 2004). Edition Presses de l'ENPC- LCPC, 2004c, Vol. 2.

7.Dhouib, A. et Blondeau, F. (2005). Colonnes ballastées: Techniques de mise en oeuvre, domaines d'application, comportement, justification, contrôle, axes de recherche et de développement. Presses de l'Ecole Nationale des ponts et Chaussées- ISBN 2- 85978- 401-2, 2005 (ENPC), Paris.

8.Schlosser S. et Unterreiner P. : Renforcement des sols par inclusions. Techniques de l'ingénieur, C245.

9. Guide technique AFPS (2012) : Procédés d'amélioration et de renforcement de sols sous actions sismiques – Presse de Pont, Paris, 231 pages.

10.Magnan J. P. (1983) : Théorie et pratique des drains verticaux. Edition Technique et Documentation – Lavoisier. Paris.

11.Queyroi D., Chaput D., Pilot G. (1985) : Amélioration des sols de fondation, choix des méthodes d'exécution. Note d'information technique du Ministère de l'Urbanisme, du Logement et des Transports. Editions du LCPC - 53p.

12. Guide technique : recommandations pour l'inspection détaillée le suivi et le diagnostic des murs en remblai renforcé par éléments géosynthétiques. Laboratoire central des ponts et chaussées Juillet 2003.

13.Holtz, R. D., (2001) : Geosyntetic For SoilReinforcment, The Ninth Spencer J. Buchanan Lecture, College Station, University Drive

14. Les ouvrages de soutènement : Guide de conception générale. SETRA- Service d'Etudes Techniques des Routes et Autoroutes - Décembre 1998.

15. Lesouvrages en Terre Armée(1979) : Recommandations et Règles de l'Art. Document LCPC-SETRA(1979).

16. Recommandations Clouterre (1991) pour la conception, le calcul, l'exécution et le contrôle des soutènements réalisés par clouage des sols. Presses de l'ENPC, 1991, Paris.

17. Le-Kouby A.,:Renforcement des digues par la technique du DeepSoilMixing. Synthèse des résultats d'essais des chantiers expérimentaux du Val d'Orléans.IFSTTAR – GERS – Laboratoire Sols Roches et Ouvrages géotechniques – 19 novembre 2014.

18.Corté J-F., Poupelloz B., et Washkowski E., (1984) : Confortement par injections des fondations d'ouvrages d'art. Rapport des laboratoires LCPC, Mai 1984.

Semester: 3
Course Unit: UEM2.1
Subject 2: Geotechnical Structure Modeling
Class Time: 22.5 hours (Practical Sessions: 1.5 hours)
Credits: 2
Weighting: 1

Learning Objectives:

To acquire practical knowledge for the design of foundations, retaining walls, and protective structures using one of the following software programs: Plaxis, Geo5, Flac, Z-SOIL, COMSOL, etc.

Recommended Prior Knowledge:

Soil Mechanics, Geotechnical Testing 1 & 2, FEA (Financial Analysis), etc.

Course Content:

Assessment Method:

Continuous Assessment: 100%

References:

User manual for the software used in the practical sessions.

Semester: S3
Course Unit: UEM2.1
Subject 3: Geographic Information Systems
Hours: 37.5 (Lectures: 1.5 hours, Practical Sessions: 1 hour)
Credits: 3
Weighting: 2

Learning Objectives:
This course aims to familiarize students with geographic information systems and their application to geotechnics.

Recommended prior knowledge:
Surveying, Computer Science, Mathematics

Course content:

Chapter 1. GIS Overview (3 weeks)
Chapter 2. Geographic Information in GIS (3 weeks)
Chapter 3. Coordinate Systems and Map Projections (3 weeks)
Chapter 4. Databases in GIS (3 weeks)
Chapter 5. Data Processing in GIS (3 weeks)

Practical Sessions:
Practical Session 1: GIS Components
Basic GIS Design, Introduction to GIS Software
Practical Session 2: Geographic Data Representation Methods in a GIS
Vector Mode, Raster Mode, Digital Terrain Model (DTM)
Practical Session 3: Data Import and Display
Data Georeferencing, Projection Systems
Lab 3: Data in GIS
Attribute Data, Spatial Data
Lab 5: Applications
Spatial Analysis

Assessment Method:
Continuous Assessment: 40%; Exam: 60%

References:

. PORNON, Henri. SIG: la dimension géographique du système d'information. Dunod, 2015.
2. CHANG, Kang-Tsung. Introduction to geographic information systems.Boston : McGraw-Hill, 2008.
3. DENÈGRE, Jean et SALGÉ, François. Introduction aux systèmes d'information géographique. Que sais-je?, 2004, vol. 2, no 3122, p. 5-11.
4. Guides du logiciel SIG.

Semester: 3
Course Unit: UET 2.1.1
Subject 1: Literature Review and Dissertation Design
Time: 22.5 hours (Lecture: 1.5 hours)
Credits: 1

Learning Objectives:
To provide students with the necessary tools to research relevant information and effectively utilize it in their final year project. To guide them through the various stages of writing a scientific document. To emphasize the importance of communication and teach them how to present their work rigorously and pedagogically.

Recommended Prior Knowledge:
Writing Methodology, Presentation Methodology

Course Content:

Part I: Documentary Research

Chapter I-1: Defining the Topic (2 Weeks)

Chapter I-2: Selecting Information Sources (2 Weeks)
- Types of resources (Libraries, Internet, etc.)
- Evaluating the quality and relevance of information sources

Chapter I-3: Locating Documents (1 Week)
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Chapter I-4: Processing Information (2 Weeks)
Chapter I-5: Presentation of the bibliography (1 week)
- Bibliography presentation systems (

Part II: Dissertation Design

Chapter II-1: Dissertation Plan and Stages (2 weeks)
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Chapter II-2: Writing techniques and standards (2 weeks)
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Chapter II-3: Workshop: Critical analysis of a manuscript (1 week)

Chapter II-4: Oral presentations and defenses (1 week)
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Chapter II-5: How to avoid plagiarism? (1 week)

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Assessment method:
Exam: 100%

1. M. Griselin et al., Guide de la communication écrite, 2e édition, Dunod, 1999.
2. J.L. Lebrun, Guide pratique de rédaction scientifique : comment écrire pour le lecteur scientifique international, Les Ulis, EDP Sciences, 2007.
3. A.Mallender Tanner, ABC de la rédaction technique : modes d'emploi, notices d'utilisation, aides en ligne, Dunod, 2002.
4. M. Greuter, Bien rédiger son mémoire ou son rapport de stage, L'Etudiant, 2007.
5. M. Boeglin, lire et rédiger à la fac. Du chaos des idées au texte structuré. L'Etudiant, 2005.
6. M. Beaud, l'art de la thèse, Editions Casbah, 1999.
7. M. Beaud, l'art de la thèse, La découverte, 2003.
8. M. Kalika, Le mémoire de Master, Dunod, 2005.

Semester: 3
Course Unit: UET 2.1.2
Subject 1: Reverse Engineering
Hours: 45 (Lectures: 1.5 hours and Workshops: 1.5 hours)
Credits: 2
Weighting: 2

Learning Objectives
- Understand the principles and objectives of Reverse Engineering (RE) in the field of Science and Technology (ST),
- Become familiar with RE tools and methods in the relevant specialization,
- Grasp the value and ethics of RE principles in product design, manufacturing, and quality assurance,
- Encourage critical thinking, technical curiosity, reasoned reverse engineering, and innovation,
- Learn to analyze, document, and model an existing system without initial documentation.

Skills targeted
- Decompose and analyze an existing system,
- Accurately reproduce a technical diagram or 3D model from an existing product,
- Apply diagnostic and simulation tools,
- Work in a group on an exploratory project,
- Identify the legal limitations of reverse engineering

Prerequisites - Fundamental knowledge in the field.

Course Content
1. Introduction to Reverse Engineering
- History, legal and ethical issues of RE,
- Definitions and fields of application: Approaches (hardware, software, processes…)
- Domains: maintenance, remanufacturing, cybersecurity, competitive intelligence

2. General Methodology
- Analysis of a "black box" system
- Functional decomposition
- Block diagrams, input/output diagrams, energy or information flow diagrams

3. Hardware Reverse Engineering
- Electrical Device – Electronic Board: visual inspection, component identification
- Use of tools: multimeter, oscilloscope, logic analyzer
- Recognition of electrical schematics
- Reconstruction of schematics using KiCad / Fritzing / Proteus / EPLAN Electric P8 / QElectroTech

4. Software Reverse Engineering
- Static analysis of binary data (e.g., .exe, .hex)
- Decompilation, disassembly (introduction to Ghidra, IDA Free, or Hopper)
- Observation of behavior: sniffing, monitoring (e.g., Wireshark)
- Microcontrollers: flash memory reading, firmware extraction

5. Mechanical Reverse Engineering
- 3D scanning: scanning, manual measurements
- Reproduction of CAD models from existing parts
- Software used: SolidWorks, Fusion360
6. Security and Intrusion Detection
- Reverse engineering in cybersecurity: malware detection, vulnerabilities
- Software signing, protections against RE (obfuscation, encryption)
7. Real-world case studies
- Analysis of an obsolete or unknown product (mouse, power supply, Bluetooth module, etc.)
- Example of reverse engineering of a mechanical part or simple system (fan, enclosure)

Examples of practical exercises (based on the 4 Engineering)

• Electrical Engineering
- Reverse engineering of an electrical device without a schematic
- Examples: Time delay relay, electrical cabinet, variable speed drive, electric machine, automation system...
- Objectives: identify the operation, draw the schematic, propose an improved variant.

- Identification of components (ICs, transistors, resistors, capacitors, etc.).

- Use of tools: multimeter, oscilloscope, logic analyzer.

- Reading and extracting firmware from a microcontroller.

- Introduction to the detection of electronic counterfeits.

• Mechanical Engineering:

- Reverse engineering of a simple mechanism
- Examples: hand pump, torque wrench, mini-press...
- Mechanical disassembly of a system (pump, gear, cylinder...).

- Measurement and reconstruction of plans or 3D models using CAD software (SolidWorks, Fusion 360).

- Identification of materials and manufacturing methods.

- Functional simulation based on the recreated model.

• Civil Engineering:
- Analysis of existing structures without plans (walls, slabs, structures, etc.).

- Examples: metal staircase, window sill, formwork.
- Study and reverse engineering of an existing structural element.
- Identification of materials, connections, and constraints.

- Modeling of the structure using Revit, AutoCAD, or SketchUp.

- Study of the rehabilitation or reproduction of existing structural elements.

• Process Engineering

- Reverse engineering of a laboratory module
- Examples: simple instruments, distillation, filtration, heat exchanger, reactor…
- Analysis of existing industrial systems (distillation column, heat exchanger, reactor…).
- Reconstruction of PFD and PID diagrams from observation of an installation.

- Identification of sensors, actuators, and control devices.

- Study of mass/energy flow in a process.

Assessment methods:
- Practical work (technical)
- Mini reverse engineering project (report + presentation)
- Final exam (multiple-choice questions + case study)
- Exam: 60% and practical work assessment: 40%

Bibliographical references:

– Reverse Engineering for Beginners – Dennis Yurichev (gratuitenligne)
– The IDA Pro Book – Chris Eagle (logiciels)
– Practical Reverse Engineering – Bruce Dang
– Documentation :
     – https://ghidra-sre.org
     – https://www.kicad.org
     – https://www.autodesk.com/products/fusion-360

**Detailed Programs by Subject
Of Some Discovery Modules (Semes 1, 2, 3)**

Semester: X
Course Unit: UED X.X
Subject: Hydrogeology
Hours: 22.5 hours (Lectures: 1.5 hours)
Credits: 1
Weighting: 1

Learning Objectives:

This course aims to introduce students to the principles of groundwater flow and its impact on the stability of geotechnical structures.

Recommended Prior Knowledge:

Geology, General Hydraulics, Soil Mechanics

Course Content:

Chapter 1. Behavior of Aquifer Systems in Reservoirs (4 Weeks)
Chapter 2. Behavior of Aquifer Systems in Pipelines (4 Weeks)
Chapter 3. Flow Networks (4 Weeks)
Chapter 4. Water Flow Control (3 Weeks)

Assessment Method:

Exam: 100%

References:

1. E. Gilli. C. Mangan, J. Mudry. Hydrogéologie : objets, méthodes, applications. Ed. Dunod.
2. G. Castany. Hydrogéologie : principes et méthodes. Ed. Dunod.

Semester: X
Course Unit: UED X.X
Subject: Geotechnical Hazards and Risks
Hours: 22.5 hours (Lectures: 1.5 hours)
Credits: 1
Weighting: 1

Learning Objectives:

This course aims to introduce students to the understanding, analysis, and assessment of certain geotechnical risks in order to better manage crisis situations and make appropriate decisions.

Recommended Prior Knowledge:

Knowledge of probability and statistics, MDS (Method of Dynamics and Seismology).

Course Content:

Chapter 1. Introduction to Geotechnical Risks (1 Week)
Chapter 2. General Methodology for Risk Analysis (4 Weeks)
Chapter 3. Remote Sensing Applied to the Natural Environment (4 Weeks)
Chapter 4. Methodology for Data Analysis and Processing (4 Weeks)
Chapter 5. Early Warning and Crisis Management Systems (2 Weeks)

Proposed Course Content:

Chapter 1. Introduction to Geotechnical Risks (1 Week)
Chapter 2. Analysis of Different Geotechnical Risks (3 Weeks)
Chapter 3. General Methodology for Risk Analysis (3 Weeks)
Chapter 4. Remote Sensing Applied to the Natural Environment (3 Weeks)
Chapter 5. Methodology for Data Analysis and Processing (3 Weeks)
Chapter 6. Early Warning and Crisis Management Systems (2 Weeks) Weeks)

Assessment Method:

Exam: 100%

Bibliographical References:

1. M. Merad. Aide à la décision et expertise en gestion des risques. Ed. Lavoisier.
2. J.P. Louisot. Risk Management et stratégie. Ed. AFNOR.
3. J.L. Wybo. Maitrise des risques et prévention des crises. Ed. Lavoisier.

4-Techniques et Méthodes : Retrait gonflement : Analyse et traitement des désordres créés par la sécheresse. Guide 3, Edition IFSTTAR, Juillet 2017.

5-Office Fédérale des routes OFROU : Analyse de risques pour les tunnels des routes nationales Edition ASTRA ; 2014.

6-Kergomard C. : La Télédétection aéro-spatiale : une introduction. Cours de L'Ecole Nationale Supérieure de Paris.

7-Recommandations de l'AFTES : Caractérisation des incertitudes et des risques géologiques, hydrogéologiques et géotechniques. GT32R2F1, Juillet –Août 2012.

8-Guide méthodologique : La gestion des risques dans les grands projets d'infrastructure publique. Edition : Infrastructure Québec.

9-Techniques de l'Ingénieur : Dossier ''Sécurité et gestion des risques''. (www.techniques-ingénieur.fr/traite/securite_et_gestion_des_risques/T1112)

Semester X
Course Unit: X.X
Subject: Finite Difference Method
Hours: 22.5 hours (Lectures: 1.5 hours)
Credits: 1
Weighting: 1

Learning Objectives:

This course aims to introduce students to the calculation of geotechnical structures using the finite difference method.

Recommended Prior Knowledge:

Mathematical Analysis, Matrix Calculus, Strength of Materials, Soil Mechanics.

Course Content:

Chapter 1. General Principles (3 Weeks)
Chapter 2. Finite Difference Method in 1D (4 Weeks)
Chapter 3. Finite Difference Method in 2D (4 Weeks)
Chapter 4. Case Studies (4 Weeks)

Practical Sessions

Part 1 using Matlab (or other): Implementation of the finite difference method for a simple case (Beam bending, Consolidation problem).

Part 2: Use of finite difference software in geotechnical engineering (Flac or other) and study of a practical case: Problem modeling, Domain discretization, Meshing, Introduction of boundary and initial conditions, Solution and analysis of results.

Assessment Method:

Continuous assessment: 40%; Final exam: 60%

References

1. A. Curnier. Méthodes numériques en mécanique des solides.Ed. Presses polytechniques et universitaires romandes.
2. M. Deville, M. Rappaz.Modélisation numérique en science et génie des matériaux. Ed. Presses polytechniques et universitaires romandes.
3. M. Rappaz, M. Bellet, M. Deville.Traité des matériaux 10. Ed. Presses polytechniques et universitaires romandes.
4. G. Allaire.Analyse numérique et optimisation : une introduction à la modélisation. Ed. Ecole polytechnique, France.

Semester: X
Course Unit: UED X.X
Subject: Pathology of Geotechnical Structures
Hours: 22.5 (Lectures: 1.5 hours)
Credits: 1
Weighting: 1

Learning Objectives:

This course aims to introduce students to the main pathological issues related to geotechnical structures, diagnostic techniques, and possible repair methods.

Recommended Prior Knowledge:

Course Content:

It covers the following points:

- Analysis of the causes of problems (construction errors, site instability, structural defects, changes in the characteristics of the foundation soil, environmental changes).

- Causes related to structures (constituent materials, undersizing, construction errors).

- Causes related to problematic soils (expansive soils, collapsible soils, and liquefiable soils).

- Pathologies of shallow and deep foundations.
- Pathology of retaining structures.

- Methods of prevention and repair of damaged structures.

Proposed new course content:

- Definition of pathology and general information on diagnosis and causes of pathologies,
- Pathologies of shallow and deep foundations,
- Pathology of retaining structures,
- Pathology of tunnels and underground structures,
- Pathology of drainage structures,
- Pathologies of roads and highways,
- Methods of prevention and repair of damaged structures.

Bibliography

1. M. Lor. (2015), Pathologie, diagnostic, prévention et maintenance des structures (C7100 V1). Ed. Techniques de l'ingénieur.
2. J. Delefosse. Pathologies du béton armé – Actions physico-chimiques, cas particuliers et ouvrages spécifiques (C6200 V2). Ed. Techniques de l'ingénieur.

3. A. Plumier. (2011), Pathologies et réparations structurales des constructions.Cours de l'université de liège.
4. L. Logeais (2012), La pathologie des fondations – Fondasol. Edition Moniteur.
5. Pathologie des fondations superficielles : diagnostic, réparation et prévention – maisons individuelles et bâtiments assimilés. CSTB Editions 2015.
6. Guide de l'inspection du génie civil des tunnels routiers. Du désordre vers le diagnostic – livre 1 – Catalogue des désordres – livre 2 – Les Guides du CETU – 2015.
7. Retrait et gonflement des argiles : Analyse et traitement des désordres créées par la sécheresse. Technique et Méthodes – Guide 3 – Quide Technique IFSTTAR 2017.

Semester: X
Course Unit: UED X.X
Subject: Public Procurement Code
Time: 22.5 hours (Lecture: 1.5 hours)
Credits: 1
Weighting: 1

Learning Objectives:

Recommended Prior Knowledge:

Course Content:

Assessment Method:

Exam: 100%

Bibliography:

Semester: X
Course Unit: UED X.X
Subject: Geotechnical Hazards and Risks
Hours: 22.5 hours (Lectures: 1.5 hours)
Credits: 1
Weighting: 1

Learning Objectives:

This course aims to introduce students to the various geotechnical standards in force in Algeria and to raise their awareness of compliance with regulatory requirements in geotechnical projects (design, calculation, execution, contractual relationships, etc.).

Recommended Prior Knowledge:

Soil Mechanics 1 and 2, Foundations and Geotechnical Structures.

Course Content:

This course covers the following points:

- Testing Standards: experimental procedures and techniques for analyzing test results (in-situ and laboratory tests).

- Design and Calculation Standards (foundations, retaining structures, barriers, etc.).

- Standards for the execution, monitoring, and control of geotechnical structures.

Overview of European (Eurocode 7), American (ASTM: Geotechnical Engineering Standards), etc. standards.

Assessment method:

Review: 100%

Bibliographical references:

1. Normes algériennes éditées sous l'égide de l'Institut Algérien de Normalisation (IANOR, 2010).
2. Normes européennes : https://www.icab.fr/guide/eurocode/eurocode7.html
3. Normes américaines : https://www.astm.org/Standards/geotechnical-engineering-standards.html