الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research
اللجنة البيداغوجية الوطنية لميدان العلوم والتكنولوجيا
National Pedagogical Committee for the Field of Science and Technology

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*	*Materials in Civil Engineering*

I – Master Program Identity Sheet

Access conditions

Sector	Harmonized Master	Licenses giving access to the master's degree	Ranking by license compatibility	Coefficient assigned to the license
Civil engineering	**Materials in civil engineering**	Civil Engineering	1	1.00
		Public works	1	1.00
		Hydraulic	2	0.80
		Materials Engineering	2	0.80
		Materials Chemistry (SM Domain)	2	0.80
		Materials Physics (SM Domain)	2	0.80
		Metallurgy	3	0.70
		Other licenses in the ST domain	5	0.60

II – Semester Organization Sheets for the Specialty Courses

Semester 1   Master : Materials in Civil Engineering

Educating Unit	Materials	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
	Title			Course	DW	PW			Continuous control	Exam
Fundamental Unit Code : UEF 1.1.**1** Credits: 8 Coefficients : 4	Elasticity Theory	4	2	1h30	1h30		45h00	55h00	40%	60%
	Mineral Binders	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental Unit Code : UEF 1.1.2 Credits: 9 Coefficients : 5	Concrete Technology	4	2	1h30	1h30		45h00	55h00	40%	60%
	Reinforced Concrete Structures	5	3	3h00	1h30		67h30	82h30	40%	60%
Methodological Unit Code: UEM 1.1 Credits: 11 Coefficients : 6	PW Materials Physics	2	1			1h30	22h30	27h30	100%	
	PW Binders	3	1			2h30	37h30	37h30	100%	
	PW Concrete Technology	4	2			3h00	45h00	55h00	100%	
	Advanced Programming in Python	2	2	1h30		1h30	45h00	27h30	40%	60%
Discovery Unit Code : UED 1.1 Credits: 2 Coefficients: 2	Pathologies and Rehabilitation of Structures	1	1	1h30			22h30	02h30		100%
	Ecological materials and sustainable development	1	1	1h30			22h30	02h30		100%
Total semestre 1		**30**	**17**	**12h00**	**6h00**	**8h30**	**397h30**	**375h00**		

Semester 2   Master : Materials in Civil Engineering

Educating Unit	Materials	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
	Title			Course	DW	PW			Continuous control	Exam
Fundamental Unit Code: UEF 1.2.1 Credits: 10 Coefficients : 5	Plasticity and damage	6	3	3h00	1h30		67h30	82h30	40%	60%
	Special building materials	4	2	3h00			45h00	55h00		100%
Fundamental Unit Code: UEF 1.2.2 Credits: 8 Coefficients : 4	Innovative concretes 1	4	2	3h00			45h00	55h00		100%
	Metallic frame works	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodological Unit Code: UEM 1.2 Credits: 9 Coefficients : 5	PW Mechanics of materials	2	1			1h30	22h30	27h30	100%	
	Computer science applied to the calculation of reinforced concrete structures	3	2			2h30	37h30	37h30	100%	
	Experimental methods	4	2	1h30		1h30	45h00	55h00	40%	60%
Transversal Unit Code : UET 1.2 Credits: 3 Coefficients : 3	Elements of Applied AI	2	2	1h30	1h30		45h00	05h00	40%	60%
	Compliance with Standards and Rules of Ethics and Integrity	1	1	1h30			22h30	02h30		100%
Total semestre 2		**30**	**17**	**16h30**	**3h00**	**7h00**	**375h00**	**375h00**		

Semester 3   Master : Materials in Civil Engineering

Educating Unit	Materials	Credits	Coefficient	Weekly hourly volume			Semester Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
	Title			Course	DW	PW			Continuous control	Exam
Fundamental Unit Code : UEF 2.1.1 Credits: 12 Coefficients : 6	Composite materials	4	2	1h30	1h30		45h00	55h00	40%	60%
	Recycled materials	4	2	1h30	1h30		45h00	55h00	40%	60%
	Prestressed concrete	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental Unit Code : UEF2.1.2 Credits: 6 Coefficients : 3	Materials durability	4	2	3h00			45h00	55h00		100%
	Innovative concretes 2	2	1	1h30			22h30	27h30		100%
Methodological Unit Code : UEM 2.1 Credits: 9 Coefficients : 5	Finite element methods	4	2	1h30		1h30	45h00	55h00	40%	60%
	PW Materials durability	2	1			1h30	22h30	27h30	100%	
	PW Innovative concretes	3	2			2h30	37h30	37h30	100%	
Transversal Unit 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 Atelier		45h00	05h00	40%	60%
Total semestre 3		**30**	**17**	15h00	4h30	7h00	**375h00**	**375h00**		

Semester 4

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

	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

This table is given as indicative.

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

III – Detailed Program by Subject for Semester 1 (S1)

Semester : 1
Teaching unit : UEF 1.1.1
Matter: Elasticity Theory
VHS : 45h00 (Course: 1h30, DW : 1h30)
Credits : 4
Coefficient : 2

Learning Objectives:
To define the behavior of elastic solid continua, understand the deformation mechanisms of materials in the elastic range, and be able to perform some calculations.

Recommended Prior Knowledge:

Differential Equations, Strength of Materials

Course Content:

Chapter 1. Generalities on the Theory of Elasticity (3 Weeks)

Chapter 2. Theory of Stress (4 Weeks)

Chapter 3. Theory of Strain (4 Weeks)

Chapter 4. Relationships Between Stress and Strain (4 Weeks)

Assessment Method:

Continuous Assessment: 40%; Final Exam: 60%

References:

TIMOSHENKO (S.P.) et GOODIER (J.N.). – *Théorie de l'élasticité.*544 p., 2 éd. Béranger (1961
COURBON (J.). – *Calcul des structures.*Dunod (1972).
f.frey, Analyse des structures et milieux continus méthode des éléments finis volume 6 ,p.p.u.r.
J.COURBON, Plaques minces élastiques. Eyrolles
R.L'HERMITE,Leflombageélasto-plastique des systèmes de barres droites. Eyrolles
S.TIMOSHINKO, Théorie de la stabilité élastique. Dunod
A.PFLUGER , Élément de statique des coques. Dunod
M. Tichy et J. Rakosnik, « Calcul plastique des ossatures en béton », Eyrolles, 1975.

William A. Nash, « Résistance des matériaux 1 : Cours et problèmes », série Schaum,

Semester : 1
Teaching unit : UEF 1.1.1
Matter: Mineral Binders
VHS : 45h00 (Course: 1h30, DW : 1h30)
Credits: 4
Coefficient : 2

Learning Objectives:

Understanding binders (aerial and hydraulic): composition, manufacturing, properties, and uses

Recommended Prior Knowledge:

General Chemistry, Materials Science

Course Content:

Chapter 1. Classification of Binders and Regulatory Aspects

Chapter 2. Ordinary and Composite Cements: Manufacturing, Properties, Standards, and Uses

Chapter 3. Hydraulic Limes: Manufacturing, Properties, Standards, and Uses

Chapter 4. Air Lime: Manufacturing, Properties, Standards, and Uses

Chapter 5. Plaster: Manufacturing, Properties, Standards, and Uses

Assessment Methods:
Continuous Assessment: 40%; Final Examination: 60%

Semester :1
Teaching unit : UEF 1.1.2
Matter: Concrete Technology
VHS :45h00 (Course: 1h30, DW : 1h30)
Credits: 4
Coefficient : 2

Learning objectives:

To describe the constituents of concrete, the main formulation methods, and technological solutions in terms of mixing, placement, additives, and admixtures.

Recommended prior knowledge:

Physical and chemical properties of materials. Construction materials.

Course Content:

Chapter 1. Definition and Constituents of Concrete **(1 Week)**
Chapter 2. Chemical Admixtures **(2 Weeks)**
Chapter 3. Mineral Additives **(2 Weeks)**
Chapter 4. Concrete Mix Design **(3 Weeks)**
Chapter 5. Properties of Concrete in Fresh and Hardened States **(3 Weeks)**
Chapter 6. Concrete Shrinkage and Creep **(1 Week)**
Chapter 6. Concrete Placement **(1 Week)**
Chapter 7. Concrete Control and Quality **(1 Week)**
Chapter 8. Recent Advances in Concrete Technology **(1 Week)**

Assessment Method:

Continuous Assessment: 40%; Final Examination: 60%

References:

1. Neville M.A., (2000), Propriétés des bétons. Ed. Eyrolles, France, 806p.
2. Mehta P.K., Monteiro P.J.M., (2003), Concrete: Structure, Properties and Materials, Third Edition, Prentice-Hall, 652p.
3. Aitcin P.C., (2008), Binders for Durable and Sustainable Concrete, Ed. Taylor & Francis, 529p.
4. Aitcin P.C., (2000), Bétons haute performance, Ed. Eyrolles France,700p.
5. Siddique R., (2008), Waste materials and by-products in concrete, Ed. Springer-Verlag Berlin Heidelberg, 427p.
6. Ollivier J-P., Baron J., (1997), Les bétons: Bases et données pour leur formulation, Ed Eyrolles, 522p.
7. Newman J., Choo B.S., (2004), Advanced Concrete Technology 1, Constituent Materials, Elsevier Edition, 288p.
8. Newman J., Choo B.S., (2004), Advanced Concrete Technology 2, Concrete Properties, Elsevier Edition, 352p

Semester :1
Teaching unit : UEF 1.1.2
Matter: Reinforced Concrete Structures
VHS :45h00 (Course: 3h00, DW : 1h30)
Credits: 5
Coefficient : 3

Learning Objectives:

To select and use appropriate calculation methods for the preliminary and final dimensioning of structural elements.

Recommended Prior Knowledge:

Calculation of stresses. calculation of reinforced concrete cross-sections (simple tension. simple compression. simple bending. combined bending. buckling).

Course Content:

Chapter 1: Floors and Slabs **(3 weeks)**

Chapter 2: Stairs **(1 week)**

Chapter 3: Beams **(3 weeks)**

Chapter 4: Columns **(2 weeks)**

Chapter 5: Shear Walls **(3 weeks)**

Chapter 6: Foundations **(3 weeks)**

References (Books and course materials. websites, etc.).

1- Georges Dreux, « Calcul pratique du béton armé. Règles B.A.E.L 80 », Eyrolles, 1981.
2- A. Guerrin et R. C. Lavaur, « Traité de béton armé ; Propriétés générales mécanique expérimentale du béton armé, Tome 1 », Dunod, 1973.
3- A. Guerrin et R. C. Lavaur, « Traité de béton armé ; Ossatures d'immeubles et d'usines, planchers, escaliers, encorbellements, ouvrages divers du bâtiment, Tome 4 », Dunod, 1971.
5- A. Guerrin et R. C. Lavaur, «Traité de béton armé ; Murs de soutenement et murs de quai, Tome 7 », Dunod, 1976.
6- Jean Pierre Mougin, « Béton armé, BAEL 91 modifié 99 et DTU associés », Eyrolles, 2000.
7- M. Albiges et M. Mingasson, « Théorie et Pratique du béton armé aux états limites », Eyrolles, 1981.
8- Règles BAEL 91, « Règles techniques de conception et de calcul des ouvrages et constructions en béton armé suivant la méthode des états limites », Eyrolles, mars 1992.
9- H. Renaud et F. Letertre, « Ouvrages en béton armé », Foucher, 1985.
10- Georges Dreux, « Nouveau guide du béton », Eyrolles, 1985.
11- Georges Dreux, « Calcul pratique du béton armé. Règles BAEL 83 », 1983
12- R. Park et T. Paulay, « Reinforcedconcrete structures », John Wiley et Sons.
13- Eurocode 2, Calcul des structures en béton - Partie 1-1 : règles générales et règles pour les bâtiments, NF EN 1992-1-1 Octobre 2005.
14- Christian Albouy, « Eurocode2: béton armé - éléments simples », CERPET – STI, 2007.
15- J. A. Calgaro, « Applications de l'Eurocode 2 - Calcul des bâtiments en béton », ponts et chaussée, 2007.

Semester :1
Teaching unit : UEM1.1
Matter: PW Materials Physics
VHS :22h30 (PW :1h30)
Credits: 2
Coefficient : 1

Learning Objectives:

To understand and perform various physical tests on construction materials.

Recommended Prior Knowledge:

Physical and chemical properties of materials. Construction materials.

Course Content:

Practical work 1: Particle Size Analysis

Practical work 2: Density

Practical work 3: Content and Absorption

Practical work 4: Micro-Deval Test, Los Angeles, Dynamic Diffraction

Practical work 5: Aggregate Cleanliness

Practical work 6: Mechanical Strength Tests

Assessment Method:

Continuous Assessment: 100%; Examination: 0%.

Semester :1
Teaching unit: UEM1.1
Matter: PW Binders
VHS :37h30 (PW : 2h30)
Credits:3
Coefficient : 1

Learning Objectives:

To characterize mineral binders (plaster, lime, and cement)

Recommended Prior Knowledge:

Physical and chemical properties of materials. Construction materials, mineral binders

Course Content:

Practical Session 1. Tests on Cements:

- Setting test, laser particle size analysis, loss on ignition, insoluble residue, fineness, density
- Analysis by fluorescence spectrometry, mineralogical analysis by X-ray diffraction.
- Determination of compressive strength
- Determination of flexural strength

Practical Session 2. Tests on Hydraulic Lime:

- Determination of initial setting time
- Determination of volume stability
- Determination of compressive strength

Practical Session 3. Tests on Air Lime

- Determination of Calcium and Magnesium Oxide Content
- Determination of Active Lime Content
- Determination of Quicklime Reactivity
- Determination of Grit Size

Practical Exercise 4: Tests on Plaster

- Determination of Pouring and Smoothing Time
- Determination of Grit Size
- Determination of Compressive Strength
- Determination of Flexural Strength
- Determination of Impurity Content

Assessment Method:

Continuous Assessment: 100%; Examination: 0%

Semester :1
Teaching unit : UEM 1.1
Matter: PW Concrete Technology
VHS :45h00 (PW : 3h00)
Credits:4
Coefficient :2

Learning Objectives:

Practical work training and introduction to experimental methods.

Recommended Prior Knowledge:

Construction materials, Concrete technology

Course Content:

Practical Session 1: Concrete Mix Design

- Dreux-Gorise Method
- Baron-Lesage Method

Practical Session 2: Workability Tests
Abrams cone, LCPC workability tester, etc.

Practical Session 3: Effect of Admixtures on Concrete
Grub tests, saturation dosage

Practical Session 4: Mechanical Tests
Compression, flexural, splitting

Assessment Method:

Continuous assessment: 100%: Final exam: 0%.

Semester : 1
Teaching unit: UET 1.1.1
Matter: Advanced Programming in Python
VHS: 45h00 (Course 1h30, PW 1h30)
Credits: 2
Coefficient: 2

Skills Targeted:

- 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)

1. Introduction: Basic computer science concepts and digital tools, Python installation.
2. Introduction to the concept of an operating system: Roles, types (Linux, Windows, etc.), priority management.
3. Introduction to computer networks (Principles, IP address, DNS, internet, etc.).
4. Basic programming: Interactive and script modes, variables, data types, operators. Conditional structures and loops (if, for, while).
5. Essential functions and elements: Predefined functions and function creation. Standard modules (math, random). Strings, lists, basic database manipulation.
6. Files, lists, tuples, dictionaries.
7. Exercises:
• Python learning exercises
• Exercises using the libraries covered in the course (Math, Random, NumPy, Pandas, e**tc.)**

Chapter 2: Programming and Automation (4 weeks)

1. Principles of Task Automation

• Python Libraries for Automation: Pandas and NumPy.

• Os, shutil: file and folder manipulation

• Openpyxl or pandas: working with Excel or CSV files

• Definitions and automation examples (sending emails, etc.)

2. File Manipulation with Python:

• Using libraries to:

• Browse a folder (os.listdir)

• Check for the existence of a file or folder (os.path.exists)

• Create or delete folders (os.mkdir, os.rmdir)

• Visualize data: Matplotlib, Seaborn, Plitly

• Request to interact with Application Programming Interfaces (APIs)

• Beautiful Soup for data scraping

• Tkinter, PyQt for visualizing graphical data

• Copy or move files with shutil…

• Search, sort, and generate simple reports.

• Serialization and Deserialization (Using the pickle module).

• Object Serialization and Large File Processing (Streaming).

3. Exercises:

• Using openpyxl and pandas to read, modify, and write Excel or CSV files to:
  - Create automatic reports
  - Automatically extract data

• Writing scripts to:
  - Process text files (searching, sorting)
  - Automate technical calculations
  - Manage simple reports (PDF, Excel)

• Sorting, searching, and insertion sort algorithms

• Implement a search function in a list.

• File operations

• Secure browsing (configuring simple networks, managing passwords)

Chapter 3: Advanced Excel (2 weeks)

1. Macro principles and creating a simple macro,

2. Pivot tables,

3. Column charts,

4. Bar charts,

5. Spider chart,

6. Etc.

7. Excel exercises…

Chapter 4: GanttProject (2 weeks)

1. Introduction to project management:

• What is a project?

• What are the challenges of project management?

• GanttProject Interface

2. Tasks (creation, modification, organization)
3. Time Management (project start and end dates)
4. Resource Management
5. GanttProject Exercises

Chapter 4: Advanced Object-Oriented Programming (3 weeks)

1. Code Organization:
• Custom functions, parameters, return values.
• Modules, imports, and packages.
2. Complex Data Structures:
• Lists, tuples, and dictionaries: creation, modification, deletion, traversal.
3. Fndamental Concepts of Object-Oriented Programming (OOP):
• Classes, objects, attributes, and methods.
• Public, private, and protected attributes.
4. Special Methods:
• init, str, repr, len.
5. Advanced Concepts:
• Encapsulation, abstraction, inheritance, polymorphism.
• Advanced inheritance, decorators, design patterns, metaclasses.
6. Exercises

Chapter 5: Introduction to Data for AI (2 weeks)

Bibliographie

[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
Teaching unit : UED
Matter: Pathologies and Rehabilitation of Structures
VHS : 22h30 (Course: 1h30)
Credits : 2
Coefficient : 1

Learning Objectives:

To understand building pathologies in order to repair them

Recommended Prior Knowledge: MDC, Mineral Binders, Concrete Technology

Course Content:

Chapter 1: Evaluation and Diagnosis of Concrete Structures

Chapter 2: Main Building Pathologies

Chapter 3: Building Inspection Methods

Chapter 4: Main Repair Materials

Chapter 5: Main Repair Techniques

Chapter 6: Strengthening of Structures

Chapter 7: Monitoring and Maintenance of Structures

Assessment Method:

Exam: 100%

IV – Detailed Program by Subject for Semester 2 (S2)

Semester :2
Teaching unit : UEF 1.2.1
Matter: Plasticity and damage
VHS : 67h30 (Course: 3h00, DW : 1h30)
Credits: 6
Coefficient : 3

Learning Objectives:

To understand the deformation mechanisms of materials in the plastic domain and to enable students to design structures in the plastic domain.

Recommended Prior Knowledge:

Differential equations. Strength of Materials. Elasticity.

Course Content:

Chapter 1: Introduction

Chapter 2: Appearance and Phenomena

Chapter 3: Behavior and Criteria for Plasticity

Chapter 4: Law of Plastic Constitutive Law

Chapter 5: Law of Plastic Flow

Chapter 6: Plastic Calculation Methods

Chapter 7: Linear Elastic Fracture Mechanics

Chapter 8: Extension of Fracture Mechanics

Chapter 9: Fatigue of Materials

Assessment Methods:

Continuous Assessment: 40%; Examination: 60%.

Bibliography:

C. Wielgosz, RDM, élasticité, plasticité, éléments finis, Ed Ellipses.
R. Guenfoud, introduction à la théorie non linéaire, Ed DPU Guelma
M. Tichy et j. Rakosnik, « calcul plastique des ossatures en béton », eyrolles, 1975.

Semester :2
Teaching unit : UEF 1.2.1
Matter: Special building materials
VHS : 45h00 (Course: 3h00)
Credits : 4
Coefficient : 2

Learning Objectives:

To equip students with knowledge of other materials used in the construction industry, as well as their properties.

Recommended Prior Knowledge:

Construction Materials 1.

Course Content:

Chapter 1: Wood

Chapter 2: Glass

Chapter 3: Ceramic Materials

Chapter 4: Bituminous Materials

Chapter 5: Polymers

Chapter 6: Compressed Earth Products

Assessment Method:

Continuous Assessment: 0%: Final Examination: 100%.

Semester : 2
Teaching unit : UEF 1.2.2
Matter: Innovative concretes 1
VHS : 45h00 (Course: 3h00)
Credits: 4
Coefficient : 2

Learning Objectives:

To design innovative materials for targeted civil engineering applications and to contextualize a material with highly varied properties defined a priori within the framework of a construction project.

Recommended Prior Knowledge:

Construction Materials. Concrete Technology

Course Content:

Chapter 1: Properties and Performance of Materials

Chapter 2: High-Performance Concrete

Chapter 3: Self-Compacting Concrete

Chapter 4: Fiber-Reinforced Concrete

Chapter 5: Reactive Powder Concrete

Chapter 6: Polymer-Based Concrete

Chapter 7: Lightweight Concrete

Chapter 8: Heavyweight Concrete

Chapter 9: Concrete Made with Recycled Aggregates

Assessment Method:

Continuous Assessment: 0%: Final Examination: 100%

References:

Jean-Marie Renouard, Gilles Pijaudier-Cabot. Comportement mécanique du béton, chapitre 8. Lavoisier 2005. p 283
G. D.Taylor. Materials in Construction. 3rd ed. Longman 2000
P. K. Mehta and P. J. Monterio. Concrete Microstructure, properties and materials. 3rd McGraw-Hill. 2006 p.659
Bill Price, B H P. Advanced concrete technology. Chapter 3. Elsevier Ltd. 2003 p.
Caijun Shi. Y. Mo. High performance construction materials. World Scientific Publishing. 2008 p.431
C. Hall. Civil Engineering materials. 5th ed. 1996 p. 527
H. F. W. Taylor. Cement Chemistry. 2nd ed. 1997 p. 469
G D Taylor. Materials in construction (2000), 3 ed. 332p

Semester : 2
Teaching unit : UEF 1.2.2
Matter: Metallic frame works
VHS : 45h00 (Course: 1h30, DW : 1h30)
Credits: 4
Coefficient : 2

Learning Objectives:

To design structural elements and simple welded or bolted connections according to Eurocode 3.

Recommended Prior Knowledge:

Structural Mechanics (STM) - Drawing diagrams (M. N. T) for structures - various solution methods (trusses. continuous beams. frames).

Course Content:

Chapter 1: Connection Design (6 weeks)

- Welding
- Ordinary Bolts
- High-strength bolts with controlled tightening

Chapter 2: Column Base Design (4 weeks)

- Hinges
- Fixed Connections

Chapter 3: Composite Slab Design (3 weeks)

- Strength Calculations
- Deformation Calculations
- Connector Designs

Chapter 4: Design of Industrial Buildings (2 weeks)

Assessment Methods:

Continuous Assessment: 0%; Final Exam: 100%.

Bibliographical references:

1- Règles de calcul des constructions en acier (CM66), Eyrolles, 1979.
2- Règles définissant les effets de la neige et du vent sur les constructions et annexes (Règles N.V.65), Eyrolles, 1980.
3- Eurocode 3, « Calcul des structures en acier », NF EN 1993-1-1, 2005.
4- J.MOREL , Conception et calcul des structures métalique, Eyrolles
5- J.brozzetti, Calcul des structures en acier : eurocode 3, Eyrolles
6- A. Manfred, Charpentes métallique : conception et dimensionnement des halles et bâtiments volume 11, PPEUR

Semester : 2
Teaching unit : UEM1.2
Matter: PW Mechanics of materials
VHS :22h30 (PW : 1h30)
Credits: 2
Coefficient : 1

Learning Objectives:

To identify the mechanical properties of materials and understand the influence of several parameters.

Recommended Prior Knowledge:

Construction Materials. Concrete Technology

Course Content:

Practical Session 1: Mechanical Tests (Compression, Tension, Flexure)

Practical Session 2: Effects of Several Parameters Influencing the Mechanical Properties of Materials

- Effect of the Water/Cement Ratio
- Effect of Curing
- Effect of Admixtures

Practical Session 3: Concrete Rheology - Determination of Yield Strength and Plastic Viscosity

Practical Session 4: Scale Effect on the Properties of Mortar and Concrete Specimens

Practical Session 5: Tensile Tests on Steel

Practical Session 6: Steel-Concrete Bond Tests

Assessment Method:

Continuous Assessment: 100%

Semester : 2
Teaching unit : UEM1.2
Matter: Computer science applied to the calculation of reinforced concrete structures
VHS :37h30 (PW : 2h30)
Credits: 3
Coefficient : 2

Learning Objectives:

To train students in the use of professional software that allows them to design and calculate structures.

Recommended Prior Knowledge:

Physical and chemical properties of materials. Construction materials. mineral binders.

Course Content:

- Software training
- Three-dimensional structural representation (modeling) as bars and plates
- Establishment of connections between bars and with external elements
- Application of loads: self-weight. snow and wind loads. live loads
- Calculation and determination of stresses in the various elements
- Calculation of reinforced concrete elements

Assessment Method:

Continuous assessment: 100%

Semester : 2
Teaching unit : UEM1.2
Matter: Experimental methods
VHS : 45h00 (Course:1h30, PW : 1h30)
Credits : 4
Coefficient : 2

Learning Objectives:

Mastery of advanced experimental investigation techniques

Recommended Prior Knowledge:

Course in Construction Materials offered within the Bachelor's degree program

Course Content:

Chapter 1: Classical Methods, Description and Application

- Gravimetry
- Volumetric Analysis
- Differential Thermal Analysis
- Calorimetric Analysis

Chapter 2: Physical and Physicochemical Methods, Description and Application

- Emission Spectroscopy, X-ray Fluorescence Spectroscopy
- X-ray Diffraction
- Scanning Electron Microscopy

Chapter 3: Mechanical Methods

- Static Tests
- Dynamic Tests
- Strain Measurement

Assessment Methods:

Continuous Assessment: 40%; Final Exam: 60%

Bibliography:

1. Wheeler A.J. and Ganji A.R. (1996), "Introduction to Engineering Experimentation", Prentice Hall, 417p.
2. Malhotra and Carino, "Handbook of Nondestructive Testing of Concrete", CRC Press, 1991
3. Montgomery, D.C. and Runger, G.C. (2003), "Applied Statistics and probability for engineers", 3rd Ed., John Wiley & Sons, 922p.
4. Goupy J. (2005), "Pratiquer les plans d'expériences". Dunod. Paris. 551p.
5. Placko D. (2000), "Fundamentals of Instrumentation and Measurement", Hermes Science Europe Ltd, 555p.
6. Technique de l'ingénieur

Semester : 2
Teaching unit : UET 1.2.1
Matter: Compliance with Standards and Rules of Ethics and Integrity
VHS : 22h30 (Course: 1h30)
Credits: 1
Coefficient : 1

Teaching Objectives:

To develop students' awareness of ethical principles and the rules governing life at the university and in the workplace. To raise their awareness of the importance of respecting and valuing 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 the rules of ethics and integrity.

1. Review of the MESRS Charter of Ethics and Professional Conduct: Integrity and honesty. Academic freedom. Mutual respect. Demand for scientific truth. Objectivity and critical thinking. Fairness. Rights and obligations of students, teachers, and administrative and technical staff
2. Ethical and responsible research
- Respect for ethical principles in teaching and research
- Responsibilities in teamwork: Equal professional treatment. Conduct against discrimination. The pursuit of the common good. Inappropriate conduct in collaborative work
- Adopting responsible conduct and combating misconduct: Adopting responsible conduct in research. Scientific fraud. Conduct against fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to prevent unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.
3. Ethics and professional conduct in the workplace:
Legal confidentiality in the workplace. Loyalty to the company. Responsibility within the company. Conflicts of interest. Integrity (corruption in the workplace, its forms, consequences, methods of combating it, and sanctions against corruption)

B- Intellectual Property

I- Fundamentals of Intellectual Property
1- Industrial Property. Literary and Artistic Property.
2- Rules for Citing References (books, scientific articles, conference papers, theses, dissertations, etc.)
II- Copyright
1. Copyright in the Digital Environment
Introduction. Copyright of Databases. Copyright of Software. Specific Case of Free Software.
2. Copyright on the Internet and E-commerce
Domain Name Law. Intellectual Property on the Internet. Law of E-commerce Websites. Intellectual Property and Social Networks.
3. Patent

Definition. Rights in a patent. Usefulness of a patent. Patentability. Patent applications in Algeria and worldwide.

III- Protection and Enhancement of Intellectual Property

How to protect intellectual property. Violation of rights and legal tools. Enhancement of intellectual property. Protection of intellectual property in Algeria.

C. Ethics, Sustainable Development, and New Technologies

Link between ethics and sustainable development, energy conservation, bioethics, and new technologies (artificial intelligence, scientific progress, humanoids, robots, drones, etc.)

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. Le télémaque, 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. Emanuela Chiriac, 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
24. http://www.app.asso.fr/

Semester : 2
Teaching unit: 1.2.2
Matter: Elements of Applied AI
VHS: 45h00 (Course 1h30, PW 1h30)
Credits: 2
Coefficient: 2

Teaching Objectives:

To develop students' awareness of ethical principles and the rules governing life at the university and in the workplace. To raise their awareness of the importance of respecting and valuing 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.

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Course Content:

A. Respect for the rules of ethics and integrity,

1. Review of the MESRS Charter of Ethics and Professional Conduct: Integrity and honesty. Academic freedom. Mutual respect. Demand for scientific truth. Objectivity and critical thinking. Fairness. Rights and obligations of students, teachers, and administrative and technical staff
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- Respect for ethical principles in teaching and research
- Responsibilities in teamwork: Equal professional treatment. Conduct against discrimination. The pursuit of the common good. Inappropriate conduct in collaborative work
- Adopting responsible conduct and combating misconduct: Adopting responsible conduct in research. Scientific fraud. Conduct against fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to prevent unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.
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B- Intellectual Property

I- Fundamentals of Intellectual Property
1- Industrial Property. Literary and Artistic Property.
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II- Copyright
1. Copyright in the Digital Environment
Introduction. Copyright of Databases, Copyright of Software. Specific Case of Free Software.
2. Copyright on the Internet and E-commerce
Domain Name Law. Intellectual Property on the Internet. Law of E-commerce Websites. Intellectual Property and Social Networks.
3. Patent

Definition. Rights in a patent. Usefulness of a patent. Patentability. Patent applications in Algeria and worldwide.

III- Protection and Enhancement of Intellectual Property

How to protect intellectual property. Violation of rights and legal tools. Enhancement of intellectual property. Protection of intellectual property in Algeria.

C. Ethics, Sustainable Development, and New Technologies

Link between ethics and sustainable development, energy conservation, bioethics, and new technologies (artificial intelligence, scientific progress, humanoids, robots, drones, etc.)

Assessment Method: Exam: 100%

Bibliographical References::

- 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

V – Detailed Program by Subject for Semester 3 (S3)

Semester : 3
Teaching unit : UEF 2.1.1
Matter: Composite Materials
VHS : 45h00 (Course: 1h30, DW : 1h30)
Credits: 4
Coefficient : 2

Learning Objectives:

To acquire basic knowledge of composite materials. To learn the fundamental concepts for developing composites and subsequently address all the design problems of laminated or sandwich structures.

Recommended Prior Knowledge: Organic Chemistry, Construction Materials, Strength of Materials, Continuum Mechanics

Course Content:

1-General Information

History, definition, classification, and applications of composites

2-Composition of Composites

- Reinforcing fibers

- Matrices (resins)

- Admixtures

- Laminates (multilayers)

3-Composite Manufacturing Technology

4-Properties of Composites

Elastic properties, Fracture properties, and Chemical properties

5-Behavior of Composites under Internal and External Loads

Assessment Method:

Continuous assessment: 40%; Examination: 60%

Bibliographical references: (If possible):

J. M. Berthelot "Matériaux composites" Ed. Lavoisier, 2005.
N. Bahlouli " Les matériaux composites"
http://www-ipst.u-strasbg.fr/nadia/courcomp/comp1.htm
J. Molimard "mécanique des matériaux composites" version 2, Septembre 2004.
D. Guy "Matériaux composites"

Semester : 3
Teaching unit : UEF 2.1.1
Matter: Recycled materials
VHS : 45h00 (Course: 1h30, DW :1h30)
Credits: 4
Coefficient : 2

Learning Objectives:

To raise students' awareness of the importance of waste recycling in the context of environmental protection and sustainable development.

Recommended Prior Knowledge: MDC, Concrete Technology, Innovative Concretes

Course Content:

- Waste Management
- Definition of Waste
- Collection, Transport, and Storage
- Waste Treatment
- Costs in Waste Management
- Environmental Impact Assessment
- Life Cycle and Sustainable Development
- Industrial By-products and their Use in Civil Engineering
- Blast Furnace Slag, Steel Mill Slag, and Fly Ash
- Recycling
- Recycling: Definition and Challenges
- Alternative Materials Deposits and Management
- Concrete Recycling
- Cement Industry Recycling
- Recycling in Pavement Construction
- Environmental Approach to Concrete Production
- Waste Recovery
- Sewage Sludge
- Dredging/Sludge
- Rubber
- Construction Waste

Assessment Method:

Continuous Assessment: 40%: Final Exam: 60%

Semester : 3
Teaching unit: UEF 2.1.1
Matter: Prestressed concrete
VHS : 45h00 (Course: 1h30, DW: 1h30)
Credits: 4
Coefficient : 2

Learning Objectives:

To understand the general principle, the materials used, and the methods of prestressing; to calculate prestress losses and to dimension a concrete section; and to understand the prestressing force in relation to normal stresses.

Recommended Prior Knowledge: Knowledge of strength of materials and reinforced concrete calculations.

Course Content:

Chapter 1: General Principles:
- General principle of prestressing.
- Materials used in prestressing.
- Methods of prestressing.

Chapter 2:
Prestress Losses: Instantaneous losses, time-dependent losses, construction losses, pretension losses.

Chapter 3:
Calculation of simply supported beams at the serviceability limit state: Design section,
load combination, verification class, justification of normal stresses, section dimensioning, prestressing force dimensioning, cable layout,
passive longitudinal reinforcement, justification of shear stresses.

Chapter 4:
Strength of a beam section at the ultimate limit state: load combination and material behavior, calculation of resistance moment, justification of shear stresses.

Chapter 5:
Construction details

Assessment method:
Continuous assessment: 40%; Examination: 60%.

Bibliographical references: (If possible)::

Georges Dreux, Cours pratique du béton précontraint, Règles BPEL 83 , 1983.
LACROIX (R.) et FUENTES (A.). – Le projet de béton précontraint. Eyrolles (1975).
THONIER (H.). – Le béton précontraint aux états limites. Presses de l'ENPC (1985).
CHAUSSIN (R.), MAHUT (B.) et LEBLANC (J.-Y.). – Guide d'emploi du BPEL 83. SETRA (1985).
CALGARO (J.-A.) et VIRLOGEUX (M.). – Projet et construction des ponts. Analyse structurale des tabliers de ponts. Presses de l'ENPC (1989).

Semester : 3
Teaching unit : UEF 2.1.2
Matter: Materials durability
VHS : 45h00 (Course: 3h00)
Credits: 4
Coefficient : 2

Learning Objectives:
Understanding the factors and aggressive environments and the means to protect structures against degradation

Recommended Prior Knowledge:
Construction Materials, Mineral Binders, Concrete Technology, Innovative Materials, Mineral Chemistry

Course Content:
Chapter 1: Aggressive Agents and Modes of Action
Classification of Aggressive Environments
Modes of Action of Agents
Basic Mechanisms of Interaction Between Aggressive Agents and Concrete
Porosity and Cracking: Factors in Concrete Durability
Chapter 2: Permeability and Diffusion in Concrete
Modes of Matter Transport
Interactions Between Water and Porous Media
Permeability and Diffusion in Concrete: Influencing Parameters
Influence of Hydrate Stability on Concrete Durability
Hydrate Stability in Aggressive Environments
Chapter 3: Durability of Concrete Against Aggressive Agents
Carbonation of Concrete
Concrete durability in acidic environments
Concrete durability in sulfate environments
Cryl attack on concrete
Concrete placement in hot climates
Chapter 4: Concrete placement in hot and cold climates
Chapter 5: Steel durability
Reinforcement corrosion
Steel failure by flow
Steel failure by cracking
Steel fatigue
Steel creep and relaxation
Chapter 6: Wood durability
Insect damage
Marine wood-boring insects
Fungal growth
Assessment method: Exam: 100%

Semester : 3
Teaching unit: UEF 2.1.2
Matter: Innovative concretes 2
VHS : 22h30 (Course: 1h30)
Credits: 2
Coefficient : 1

Learning Objectives:
To explore and learn about the different types of innovative concrete that can be used in specific applications.

Recommended Prior Knowledge: MDC, Concrete Technology, Innovative Concretes 1

Course Content:

Chapter 1: Mass Concrete

Chapter 2: Pavement Concrete

Chapter 3: Ready-Mix Concrete

Chapter 4: Refractory Concrete

Chapter 5: Shotcrete

Chapter 6: Pumped Concrete

Assessment Method: Exam: 100%

Semester : 3
Teaching unit : UEM 2.1
Matter: Finite element methods
VHS :452h00 (Course: 1h30, PW : 1h30)
Credits: 4
Coefficient : 2

Learning Objectives:
Familiarization with the Finite Element Method (FEM). Mastery of the basic principles of the FEM. Ability to solve problems in the field of structural analysis. Application of the Finite Element Method in the linear domain. Learning to program and developing awareness of the proper use of finite element codes.

Recommended Prior Knowledge: Elasticity and the modules on strength of materials, numerical methods, and computer science from the Bachelor's degree program.

Course Content:

Chapter 1: Approximation Methods

1. Weighted residuals method, collocation method, least squares method, Galerkin method,
2. Calculus of variation, Euler-Lagrange equation, Ritz method, strong and weak formulations,
3. Applications: Solving first- and second-order ordinary differential equations
Chapter 2: Principles of the Finite Element Method
1. Nodal approximation – shape functions,
2. Elementary strain energy,
3. Elementary work done by body and surface forces,
4. Principle of virtual work and the principle of minimum potential energy

Chapter 3: Bar and Spring Elements

1. Spring element, linear spring, spiral spring
2. Local-global numbering, connectivity table, assembly of element matrices.
3. Bar element, governing equation, direct formulation of the element.
4. Elementary stiffness matrices for a plane bar (2D bar), handling of distributed loads, simple, double, fixed, and inclined support conditions.
5. 3D spatial bar element.
6. Applications: Spring systems, combined bar-spring systems, truss systems, space trusses.

Chapter 4: Beam Elements

1. Introduction and applications, General equation of plane beams.
2. Two-node plane beam element (Bernoulli beam), element stiffness matrix and load vector.
3. Element stiffness matrix of the generalized plane beam (bending, tension, and compression), transformation of the stiffness matrix and load vector, calculation of reactions and stresses, treatment of distributed loads, equivalent loads, temperature effect, support settlement effect.
4. Timoshenko beam, universal beam.
5. Space beam element (3D).

6. Applications: Continuous beam. 2D and 3D frame.

Chapter 5: Isoparametric Elements

1. General Introduction. Meshing Problems
2. Geometric Transformation
3. Element Families. C0 Family. C1 Family
4. Elementary Characteristics
5. Numerical Integration. Gaussian Integration

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

References::
1. The finite element method, Zienckiewicz O.C. and R.L. Taylor., Mc Graw Hill, 1989. 4th edition, 2 volumes.
2. Finite Element Procedures, Bathe K.J., Prentice Hall, 1996.
3. An Introduction to the Finite Element Method, Reddy, J.N., McGraw Hill, 2005, 3rd edition.
4. Une présentation de la méthode des éléments finis, Dhatt G. et Touzot G., Maloine, 1981.
5. Finite Element Method, Dhatt G., Touzot G., and Lefrançois E., Wiley, 2012.
6. Modélisation par éléments finis : Cours et exercices corrigés, Jean-Charles Craveur, Dunod, 2008 (3e édition).
7. Méthode des éléments finis, Approche pratique en mécanique des structures, Cazenave M., Dunod, 2010.
8. MATLAB Codes for Finite Element Analysis Solids and Structures, Ferreira A.J.M., Springer 2009.
9. The finite element method using Matlab, Young W.K. and Hyochoong B., CRC Press, 1997.
10. The Finite Element Method, A Practical Course, Liu G.R. and Quek S.S., Butterworth-Heinemann, 2003.

Semester : 3
Teaching unit : UEM 2.1
Matter: PW Materials durability
VHS : 22h30 (PW : 2h30)
Credits: 3
Coefficient : 2

Learning Objectives:
To understand the phenomena of material degradation and become familiar with durability testing

Recommended Prior Knowledge: MDC, Concrete Technology, Innovative Concretes

Course Content:

Practical Session 1: Absorption by Immersion and Capillarity

Practical Session 2: Concrete Permeability

Practical Session 3: Porosity

Practical Session 4: Attack of Concrete by Sulfates

Practical Session 5: Attack of Concrete by Acids

Practical Session 6: Attack by Chlorine Ions

Assessment Method:

Continuous Assessment: 100%

Semester : 3
Teaching unit : UEM 2.1
Matter: PW Innovative concretes
VHS : 22h30 (PW : 2h30)
Credits: 3
Coefficient : 2

Learning Objectives:
To formulate innovative concrete and understand the influencing factors in its implementation.
To become familiar with innovative concretes.

Recommended Prior Knowledge: MDC, Concrete Technology, Innovative Concretes

Course Content:

Practical Session 1: High-Performance Concrete

Practical Session 2: Self-Compacting Concrete

Practical Session 3: Fiber-Reinforced Concrete

Practical Session 4: Reactive Powder Concrete

Practical Session 5: Lightweight Concretes

Practical Session 6: Heavyweight Concretes

Practical Session 7: Concretes Made with Recycled Aggregates

Assessment Method: Continuous Assessment: 100%

Semester : 3
Teaching unit: UET 1.3
Matter : Documentary Research and Thesis Design
VHS : 22h30 (Course: 1h30)
Credits: 1
Coefficient : 1

Learning Objectives:

To equip 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)
- Title of the topic
- List of keywords related to the topic
- Gathering basic information (acquiring specialized vocabulary, meaning of terms, linguistic definitions)
- Information sought
- Assessing prior knowledge in the field

Chapter I-2: Selecting Information Sources (2 Weeks)
- Types of documents (Books, Theses, Dissertations, Journal Articles, Conference Proceedings, Audiovisual Documents…)
- Types of resources (Libraries, Internet…)
- Evaluating the quality and relevance of information sources

Chapter I-3: Locating Documents (1 Week)

- Research techniques
- Search operators

Chapter I-4: Processing Information (2 Weeks)

- Organization of work
- Initial questions
- Synthesis of selected documents
- Links between different parts
- Final plan for the literature review

Chapter I-5: Presentation of the bibliography (1 week)

- Systems for presenting a bibliography (The Harvard system, The Vancouver system, The mixed system…)

- Presentation of documents.
- Citation of sources

Part II: Thesis design

Chapter II-1: Thesis plan and stages (2 weeks)

- Defining and delimiting the topic (Summary)
- Problem statement and objectives of the thesis
- Other useful sections (Acknowledgments, Table of abbreviations...)
- The introduction (Writing the introduction last)
- State of the specialized literature
- Formulation of hypotheses
- Methodology
- Results
- Discussion
- Recommendations
- Conclusion and perspectives
- The table of contents
- The bibliography
- Appendices

Chapter II-2: Writing techniques and standards (2 weeks)

- Formatting. Numbering of chapters, figures, and tables.
- The title page
- Typography and punctuation
- Writing. Scientific language: style, grammar, syntax.
- Spelling. Improvement of general language skills in terms of comprehension and expression.
- Saving, securing, and archiving data.

Chapter II-3: Workshop: Critical study of a manuscript (1 week)

Chapter II-4: Oral presentations and defenses (1 week)

- How to present a poster
- How to present an oral communication.
Defending a thesis

Chapter II-5: How to avoid plagiarism? (1 week)

(Formulas, sentences, illustrations, graphs, data, statistics, etc.)
- Quoting
- Paraphrasing
- Providing the complete bibliographic reference

Assessment method: Exam: 100%

Bibliographic references:

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
Teaching unit : UET 2.1
Matter : Reverse Engineering
VHS: 45h00 (Course: 1h30 et Workshop: 1h30)
Credits : 2
Coefficient: 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 specialization.

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)
- Behavior observation: 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

- 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.

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