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 و التكنولوجيا
National Pedagogical Committee for the Field of Science and Technology

HARMONIZATION
TRAINING OFFER
ACADEMIC MASTER'S PROGRAM

National Program Updated 2022

Field	Program	Specialization
Science and Technology	**Hydraulics**	**Urban Hydraulics**

I – Master’s identity card

Admission Requirements

(Indicate the bachelor's degree specializations that can lead to a Master's degree)

Program	Harmonized Master's Degree	Bachelor's Degrees Granting Access to the Master's Degree	Ranking Based on Bachelor's Degree Compatibility	Coefficient Assigned to the Bachelor's Degree
Hydraulics	Urban Hydraulics	Hydraulics	1	1.00
		Energy	2	0.80
		Process engineering	2	0.80
		Other licenses in the field of ST	5	0.60

II – Half-yearly organization sheets for specialty courses

Semester 1

Teaching Unit	Materials	Credits	Coef	Weekly Hours			Semester Hours (15 weeks)	Consultation Hours (15 weeks)	Evaluation Mode	
	Title			Lec	TD	Lab			Continuous Assessment	Final Exam
Foundation course Code : UEF 1.1.1 Credits : 10 Coefficients : 5	Applied Hydraulics	6	3	3h00	1h30		67h30	82h30	40%	60%
	Hydrological Analysis and Modeling	4	2	1h30	1h30		45h00	55h00	40%	60%
Foundation course Code : UEF 1.1.2 Credits : 8 Coefficients : 4	Free Surface Flow	4	2	1h30	1h30		45h00	55h00	40%	60%
	Pressurized Flow	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodology course Code : UEM 1.1 Credits : 9 Coefficients : 5	Numerical Hydraulics	3	2			2h30	37h30	37h30	100%	
	Geographic Information Systems (GIS)	4	2	1h30	1h30		45h00	55h00	40%	60%
	Hydraulic Laboratory Work	2	1			1h30	22h30	27h30	100%	
UE Discovery Code Code : UED 1.1 Credits : 2 Coefficients : 2	Automatics and Control Systems	1	1	1h30			22h30	02h30		100%
	Environmental fundamentals	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 1.1 Credits : 1 Coefficients : 1	Technical English and Terminology	1	1	1h30			22h30	02h30		100%
Total semester 1		**30**	**17**	**13h30**	**07h30**	**04h00**	**375h00**	**375h00**		

Semester 2

Teaching Unit	Materials	Credits	Coef	Weekly Hours			Semester Hours (15 weeks)	Consultation Hours (15 weeks)	Evaluation Mode	
	Title			Lec	TD	Lab			Continuous Assessment	Final Exam
Foundation course Code : UEF 2.1.1 Credits : 12 Coefficients : 6	Water treatment and desalination	4	2	1h30	1h30		45h00	55h00	40%	60%
	Hydraulic Structures	4	2	1h30	1h30		45h00	55h00	40%	60%
	Groundwater Hydraulics	4	2	1h30	1h30		45h00	55h00	40%	60%
Foundation course Code : UEF 2.1.2 Credits : 6 Coefficients : 3	Hydraulic machines and pumping stations	4	2	1h30	1h30		45h00	55h00	40%	60%
	Lab work on water treatment and purification	2	1			1h30	22h30	27h30	40%	60%
Methodology course Code : UEM 2.1 Credits : 9 Coefficients : 5	Organization and mechanization of works	2	1	1h30			22h30	27h30	40%	60%
	Lab work on hydraulic machines and pumping stations	2	1			1h30	22h30	27h30	100%	
	Modeling and simulation in hydraulics	3	2			2h30	37h30	37h30	100%	
UE Discovery Code Code : UED 2.1 Credits : 2 Coefficients : 2	Flood forecasting and flood risk management	1	1	1h30			22h30	02h30		100%
	Sustainable agriculture and territorial development	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 2.1 Credits : 1 Coefficients : 1	Ethics, deontology, and intellectual property	1	1	1h30			22h30	02h30		100%
Total semester 2		**28**	**16**	**12h00**	**06h00**	**05h30**	**352h30**	**327h30**		

Semester 3

Teaching Unit	Materials	Credits	Coef	Weekly Hours			Semester Hours (15 weeks)	Consultation Hours (15 weeks)	Evaluation Mode	
	Title			Lec	TD	Lab			Continuous Assessment	Final Exam
Foundation course Code : UEF 3.1.1 Crédits : 10 Coefficients : 5	Urban water distribution and collection	4	2	1h30	1h30		45h00	55h00	40%	60%
	Exploration and drilling techniques syllabus	4	2	1h30	1h30		45h00	55h00	40%	60%
	River engineering and sediment transport	2	1	1h30			22h30	27h30	40%	60%
Foundation course Code : UEF 3.1.2 Crédits : 8 Coefficients : 4	Wastewater treatment and reuse	4	2	1h30	1h30		45h00	55h00	40%	60%
	Integrated water resources management	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodology course Code : UEM 3.1 Crédits : 9 Coefficients : 5	Irrigation	4	2	1h30	1h30		45h00	55h00	40%	60%
	Water treatment practical	2	1			1h30	22h30	27h30	100%	
	Specialized Software	3	2			2h30	37h30	37h30	100%	
UE Discovery Code Code : UED 3.1 Crédits : 2 Coefficients : 2	Project management	1	1	1h30			22h30	02h30		100%
	Hydro economics	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 3.1 Crédits : 1 Coefficients : 1	Documentary Research and Thesis Design	1	1	1h30			22h30	02h30		100%
Total semestre 3		**30**	**17**	**13h30**	**07h30**	**04h00**	**375h00**	**375h00**		

Semester: 1
Teaching Unit: UEF 1.1.1
Subject: APPLIED HYDRAULICS
Total Hours: 67 h 30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Course Objectives:

- This course aims to deepen the concepts of drinking water supply and general hydraulics acquired during the bachelor's degree.
- It helps students understand hydraulic phenomena, the governing equations, and their solutions.
- It also covers the presentation of storage and distribution structures and their design.

Recommended prerequisites:

- Basic knowledge in mathematics
- Knowledge in Fluid Mechanics and Hydraulics
- Basics in Hydrology

Course Content:

Chapter 1: SPRING CAPTURE SYSTEMS
1.1 Generalities
1.2 Project study and preliminary works
1.3 Construction of structures
1.4 Groundwater capture
1.5 Surface water capture

Chapter 2: RESERVOIRS
2.1 Advantages
2.2 Distribution flow management
2.3 Consumption
2.4 Reservoir location
2.5 Reservoir capacity
2.6 Determination of shape and location
2.7 Construction principles
2.8 Water needs for fire protection
2.9 Remote signaling and control system installation

Chapter 3: TYPES OF PIPING (UNDER PRESSURE AND GRAVITY FLOW)
3.1 Cast iron pipes
3.2 Steel pipes
3.3 Concrete pipes
3.4 Plastic pipes

3.5 Commissioning
3.6 Identification, execution plans, and signage

Chapter 4: WATER DISTRIBUTION NETWORKS
4.1 Types of networks
4.2 Velocity and pressure conditions
4.3 Design flow rate
4.4 Calculation of branched networks
4.5 Calculation of looped networks
4.6 Network efficiency
4.7 Leak detection

Chapter 5: ACCESSORIES – VALVES AND FITTINGS
5.1 Gate valves
5.2 Strainers
5.3 Air release valves and vents
5.4 Pressure and flow reducers
5.5 Flow and pressure stabilizers
5.6 Control valves
5.7 Safety devices

Evaluation Method:

- Continuous assessment: 40%
- Final exam: 60%

References:

1. Brière F.G., *Distribution and collection of water*, Éditions de l'École Polytechnique de Montréal, 1994, 365 p.
2. Valiron F., Lyonnaise des Eaux, *Handbook for Water Supply and Sanitation Managers*, Vol. I, Water in the City - Water Supply, Paris, Technique et Documentation Lavoisier, 1994, 435 p.
3. Dupont A., *Urban Hydraulics, Vol. 2: Transport, Elevation and Water Distribution Structures*, Paris, Eyrolles, 1979, 4th ed., 484 p.
4. Bonnin J., *Urban Hydraulics Applied to Small and Medium-Sized Towns*, Paris, Eyrolles, 1986, 228 p.

Semestre : 1
Unité d'enseignement : UEF1.1.1
Matière : ANALYSE ET MODELISATION HYDROLOGIQUE
VHS : 45h (cours: 01h30, TD : 1h30)
Crédits : 4
Coefficient : 2

Objectifs de l'enseignement

- Résolution orientée vers l'exécution précise et l'analyse rationnelle des mesures et observations portant sur les facteurs hydrométéorologiques d'un phénomène, en vue d'élucider son mécanisme et ses lois de probabilité, son objectif sera souvent de mettre sur pied des méthodes de prédétermination quantitative de l'amplitude ou de la probabilité d'occurrence du dit phénomène.
- Etude est la prévision du débit des crues, soit en fonction des débits exceptionnels observés sur une longue série d'années, soit en fonction des précipitations qui les produisent.
- Utiliser différentes approches de modélisation hydrologique pour déterminer la relation pluie-débit, dans le but de prévision ou d'utilisation de tels modèles pour des bassins non jaugés

Connaissances préalables recommandées

- bases de l'hydrologie et de la climatologie
- les statistiques appliquées
- utilisation de l'outil informatique.

Contenu de la matière :

PARTIE 1 : ANALYSE HYDROLOGIQUE

Chapitre :1 NOTIONS DE PROBABILITE ET D'ANALYSE STATISTIQUES APPLIQUEE A L'HYDROLOGIE

1.1 Rappel

1.2 Types de fonctions de distribution (ou de densité) en hydrologie
1.3 valeurs extrêmes d'une variable
1.4 Théorie générale de l'ajustement statistique
- 1.4.1 Méthode des moments
- 1.4.2 Méthode du maximum de vraisemblance
- 1.4.3 Intervalles de confiance et bandes de confiance

1.5 Test d'Ajustemement
- 1.5.1 Test du Chi carré
- 1.5.2 Test de Kolmogorov-Smirnov

1.6 Mise en application
- 1.6.1 Application de la loi normale dans la détermination de la période de retour
- 1.6.2 Exemple d'ajustement d'un échantillon selon la loi de Goodrich
- 1.6.3 Ajustement de plusieurs types de couches pour le calcul des fréquences des valeurs extrêmes

Chapitre 2 : CORRELATIONS ET ANALYSE DES DONNEES

2.1 Définitions
- 2.1.1 Corrélation orthogonale
- 2.1.2 Corrélation linéaire
- 2.1.3 Autres types de corrélation
- 2.2.1 Analyse primaire de qualité
- 2.2.2 Complément statistique des données hydrologiques

2.2 Processus, variables et séries
- 2.2.1 Définitions
- 2.2.2 Valeurs caractéristiques d'une série chronologique
- 2.2.3 Lissage des séries chronologiques

2. 3 Test d'Homogénéité
- 2.3.1 Approche générale
- 2.3.2 Test d'homogénéité d'après le test la distribution de Gumbel
- 2.3.3 Test d'homogénéité d'après le test la distribution de Laplace

2.4 Mise en application

Chapitre 3 : MODELISATION HYDROLOGIQUE

3.1 La modélisation hydrologique

3.2 Quelques éléments de vocabulaire

3.3 Pourquoi des modèles hydrologiques

3.4 Différentes approches de modélisation
- Définitions
- Présentation de quelques outils
- Applications hydrologiques de modèles pluie-débit globaux
- Applications hydrologiques de modèles connexionistes

Mode d'évaluation:

Contrôle continu : 40% ; examen : 60%.

Références bibliographiques:

.

1. *Hydrologie de l'Ingénieur – G. Réméniéras, ed. EYROLLES*
2. *Hydrologie générale – José Llamas, ed. Gaëtan Morin*
3. *Initiation à l'analyse hydrologique – P. Dubreuil, ed. Masson et C^{ie}*
4. *Hydrologie – Eric Gaume, polycopie de l'Ecole Nationale des Ponts et Chaussées*
5. *HYDROLOGIE STATISTIQUE (Introduction à l'Etude des Processus Hydrométéorologiques*
6. *Application à la Prédétermination des Débits de Crues)- Jacques MIQUEL, polycopie de l'Ecole Nationale des Ponts et Chaussées*

Semester: 1
Teaching Unit: UEF 1.1.2
Subject: Free Surface Flow
Total Hours (THS): 45 hours (Lectures: 1h30/week, Tutorials: 1h30/week)
Credits: 4
Coefficient: 2

Teaching Objectives:

This course aims to deepen the understanding of general fluid mechanics (GFM) and hydraulics acquired during the bachelor's degree. It focuses on understanding free surface flow phenomena, the governing equations, and their solutions. This subject provides the theoretical foundation for several fields of hydraulics, such as sanitation, turbo machinery, irrigation, and hydraulic structures.

Recommended Prerequisites:

- Basics in mathematics
- Fundamentals of fluid mechanics

Course Content:

Chapter 1: Review of General Hydraulics Concepts

Chapter 2: Uniform Flow Regime

- 2.1 General formula for flow
- 2.2 Formulas for flow in artificial channels and natural streams
- 2.3 Flow velocity
- 2.4 Cross-sections and transverse profiles
- 2.5 Aqueducts

Chapter 3: Gradually Varied Steady Flow

- 3.1 Use of fundamental theorems (Bernoulli and Euler)
- 3.2 Specific energy
- 3.3 Critical flow regime
- 3.4 Study of varied flow regimes

Chapter 4: Gradually Varied Flow Movement

- 4.1 Generalities and assumptions
- 4.2 Differential equation of gradually varied flow
- 4.3 Backwater curves
- 4.4 Water surface profile computation for gradually varied steady flow (backwater curves)

Chapter 5: Rapidly Varied Flow Movement (Hydraulic Jump)

- 5.1 Definition

- 5.2 Lagrange's formula
- 5.3 Wave velocity and critical speed
- 5.4 Stationary hydraulic jump
    - 5.4.1 Computation of conjugate depths and jump length
    - 5.4.2 Head losses in a jump
    - 5.4.3 Locating the jump
    - 5.4.4 Practical uses of hydraulic jumps

Chapter 6: Application to Other Varied Flow Regimes

- 6.1 Submerged and unsubmerged flows
- 6.2 Cross-sectional singularities
- 6.3 Longitudinal profile singularities

Chapter 7: Flow Measurement in Open Channels

- 7.1 Classification of measurement methods
- 7.2 Volumetric methods
- 7.3 Chemical or dilution methods
- 7.4 Anderson and Allen screen methods
- 7.5 Float method
- 7.6 Velocity field-based method
- 7.7 Weir method
- 7.8 Contracted-jet method

Ealuation Method:

- Continuous Assessment: 40%
- Final Exam: 60%

Recommended References:

1. *Carlier, M. (1972), Hydraulique Générale et Appliquée, Edition Eyrolles*
2. *Comolet, R. (2002), Mécanique Expérimentale des Fluides, Edition Dunod*
3. *Viollet, P.L., Chabard, J.P., Esposito, P., Laurence, D. (2002), Mécanique des Fluides Appliquée, Presses de l'ENPC*

Semester: 1
Teaching Unit: UEF 1.1.2
Subject: Pressurized Flows
Course Hours: 45h (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Semester: 2

Course Objectives:

This course deepens the knowledge of pressurized flows under steady and unsteady regimes and familiarizes students with commonly used measuring instruments in hydraulic and petrochemical pressurized systems.

Recommended Prerequisites:

Basic knowledge of fluid mechanics.

Course Content:

Chapter 1: Review

Flow regimes, steady flow, uniform flow, unsteady flow, problems related to pressurized flow (head loss, flow rate, diameter).

Chapter 2: Potential Flow (4 weeks)

2.1 Velocity potential equation, solutions to Laplace's equation
2.2 Planar potential flows
2.3 Analytic functions of a complex variable
2.4 Unit discharge
2.5 Simple flows (wells or sources, uniform flow, flow between two solid walls, flow around a vortex at the origin)
2.6 Composite flows
2.7 Conformal transformation method, Joukovski transformation
2.8 Graphical study of irrotational flows
2.9 Analogical study of irrotational flows

Chapter 3: Steady Flows in Pressurized Pipes (5 weeks)

3.1 Laminar Flows in a Cylindrical Pipe

- Velocity distribution in laminar flow
- Friction coefficient expression
- Shear stress distribution
- Kineticenergy correction factor
- Momentum factor
- Entrance length for laminar flow
- Laminar flow between two parallel plates (plane Poiseuille flow, Couette flow, laminar boundary layer development)

3.2 Turbulent Flows

- Velocity distribution in turbulent flow
- Concept of boundary layer
- Laminarsublayer
- Mixinglength: Prandtl'sequation

- Shear stress
- Velocity distribution law
- Turbulent flow in a smooth cylindrical pipe
- Influence of roughness, Nikuradse's experiment – Moody diagram
- General formulas for steady turbulent flow in cylindrical pipes of constant diameter (classical and modern formulas), smooth, rough, and transitional turbulent regimes

3.3 FluidMeasurement Instruments

- Fluid density measurement (Westphal balance, constant volume and constant weight densimeters, U-tube)
- Viscosity measurement (MacMichael, Stormer, Saybolts, Engler, Ostwald viscometers, falling ball viscometer)
- Static and total pressure measurement (manometers, micromanometers, sensors, and conversion methods)
- Viscous stress measurement (Stanton tube, Preston tube)
- Level measurement (glass level, resistive and capacitive detectors)
- Velocity measurement (Prandtl probe, cup and vane anemometers, hot-wire and hot-film anemometers)
- Flow rate measurement (orifice plate, Venturi, nozzles, turbine flowmeter, rotameter, paddlewheel and elbow flowmeters, gas meter)

Chapter 4: Unsteady Flows in Pressurized Pipes (5 weeks)

4.1 Quasi-steady flows (draining a reservoir into a river, or into another reservoir)
4.2 Oscillatory liquid motions (in a U-tube and between two reservoirs, without resistance, with laminar resistance, with turbulent resistance)
4.3 Transient flow (flow establishment time)
4.4 Water hammer (ideal fluid, real fluid, shock wave speed, phase study, intensity of water hammer)
4.5 Water hammer protection (surge chamber, slow valve closure, relief valve, flywheel, and surge tank)

Evaluation Method:

- Continuous assessment: 40%
- Final exam: 60%

Bibliography:

1. Irving H. Shames, 2003, Mechanics of fluids, 4th ed., McGraw Hill, International Ed. ISBN 0-07-119889-X.
2. S. Candel, 1995, Mécanique des fluides cours, 2e ed, Dunod, Paris 1995, ISBN 2-10-002585-6.
3. B.S. Massy, 1975, Mechanics of fluids, 3rd ed., VNR, London 1975, ISBN 0 442 30021 2.
4. T. Allen Jr. and R. L. Ditsworth, 1972, Fluid Mechanics, Int. Student ed. McGraw-Hill Kogakusha,
5. Merzak. Damou, Mécanique des fluides, O.P.U. 03-1994. Code 2.05.3887.
6. Pump Engineering Manual, IDURCO, 1968.

Course Semester: 1
Teaching Unit: UEM 1.1
Course: Numerical Hydraulics
Total Hours (VHS): 37h30 (Practical Work: 2h30)
Credits: 3
Coefficient: 2

Objectives

The objective of this course is to teach students the various numerical methods used in hydraulics, particularly for pressurized and free surface flows.
It also aims to expose students to a broader range of numerical techniques applied in hydraulic simulation.

Recommended Prerequisites

- General hydraulics
- Programming

Course Content

- **TP 01:** Gradually varied flow: application using software tools such as HEC-RAS **(5 weeks)**
- **TP 02:** Rapidly varied flow: application on a pedagogical channel (sudden drops, hydraulic jumps, weirs, etc.) **(5 weeks)**
- **TP 03:** Pressurized flows (branched network, looped network, distribution and conveyance): application using software tools such as EPANET and WaterCAD **(5 weeks)**

Assessment Method

Continuous assessment: 100%

References

1. *Mathematical Analysis and Numerical Calculation for Science and Engineering* (Vol. 6), Robert Dautray; Jacques-Louis Lions
2. HEC-RAS software (version 2.1), U.S. Army Corps of Engineers
3. EPANET software, U.S. Environmental Protection Agency
4. *Epanet 2.0: Hydraulic and Water Quality Simulation for Pressurized Water Networks*, User Manual, French Version, 2003

Semester: 1
Teaching Unit: UEM 1.1
Course: Geographic Information Systems (GIS)
Total Hours (VHS): 45h00 (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

The objective of this course is to introduce Master's students to the use of modern geographic positioning tools and to explore the possibilities of overlaying multiple layers of spatial information.

Recommended Prerequisites

- Topography
- Mathematics
- Physics

Course Content

1. Basic GIS Design
2. Projection Systems
3. Introduction to MapInfo software
4. Digitization
5. Formatting
6. Thematic Mapping
7. Sectorization
8. Digital Terrain Model (DTM)
9. GIS Applications

Assessment Method

- Continuous assessment: 40%
- Final exam: 60%

References

1. *Remote Sensing Handbook: Principles and Methods* – F. Bonn & G. Rochon, Presses de l'Université du Québec – AUPELF
2. *Image Analysis: Filtering and Segmentation* – J.P. Cocquerez & S. Philipp, Masson Editions
3. *Remote Sensing Digital Image Analysis* – J.A. Richards & X. Jia, Springer
4. *Remote Sensing Data Processing* – M.C. Girard & C.M. Girard
5. Dunod Editions, Paris
6. *Remote Sensing: From Satellites to GIS* – Nathan Université, ROBIN

Semester: 1
Teaching Unit: UEM1.1
Subject 1: Hydraulic Laboratory Work
Total Hours: 22h30 (Laboratory Work: 1h30 per session)
Credits:2
Coefficient:1

Course Objectives:
The objective of this course is to allow the student to practice, in a laboratory setting, what they have learned regarding open channel flow.

RecommendedPrerequisites:
- General hydraulics
- Open channel flow

Course Content:
- Lab Session 01: Determination of simple and composite roughness of a sewer pipe using software (such as EPASWMM, etc.)
  (Duration: 2 weeks)
- Lab Session 02: Modeling of stormwater overflow structures using EPASWMM
  (Duration: 3 weeks)
- Lab Session 03: Modeling of hydraulic jumps using HSL software
  (Duration: 3 weeks)
- Lab Session 04: Verification of Chézy's law in the laboratory using open channels
  (Duration: 3 weeks)
- Lab Session 05: Practical determination of backwater curves in the laboratory
  (Duration: 3 weeks)
- Lab Session 06: Practical determination of backwater curves using software such as HSL
  (Duration: 3 weeks)

Evaluation Method:
- **Continuous assessment: 100%**

References:

1. . Walter Hans Graf, M. S. Altinakar, Hydraulique fluviale: écoulement et phénomènes de
2. transport dans lits des cours d'eau, 2000
3. Médéric Clément Lechalas, Hydraulique fluviale, 1884
4. L. Fargue, Hydraulique fluviale: La forme du lit des rivières a fond mobile, 1908
5. Walter Hans Graf, Hydraulique fluviale, 1996.

Semester: 1
Teaching Unit: UET 1.1
Course: Technical English and Terminology
Total Hours : 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

To introduce students to technical vocabulary, strengthen their language proficiency, help them understand and summarize technical documents, and enable them to comprehend conversations in English within a scientific context.

Recommended Prerequisites

Basic English vocabulary and grammar

Course Content

- **Reading comprehension:** Reading and analyzing texts related to the student's field of study
- **Listening comprehension:** Using authentic scientific popularization videos for note-taking, summarizing, and presenting the content
- **Oral expression:** Presenting a scientific or technical topic, developing and exchanging spoken messages (ideas and data), phone conversations, non-verbal communication
- **Written expression:** Extracting ideas from a scientific document, writing scientific messages, exchanging written information, drafting CVs and internship or job application letters

Recommendation: It is strongly recommended that the course instructor present and explain around ten technical terms related to the specialty at the end of each session in three languages (if possible): English, French, and Arabic.

Assessment Method

Final exam: 100%

References

1. P.T. Danison, *Practical Guide to Writing in English: Usage, Rules, Practical Advice*, Editions d'Organisation, 2007
2. A. Chamberlain, R. Steele, *Practical Communication Guide: English*, Didier, 1992
3. R. Ernst, *Dictionary of Technical and Applied Sciences: French-English*, Dunod, 2002
4. J. Comfort, S. Hick, A. Savage, *Basic Technical English*, Oxford University Press, 1980
5. E.H. Glendinning, N. Glendinning, *Oxford English for Electrical and Mechanical Engineering*, Oxford University Press, 1995
6. T.N. Huckin, A.L. Olsen, *Technical Writing and Professional Communication for Non-Native Speakers of English*, McGraw-Hill, 1991
7. J. Orasanu, *Reading Comprehension from Research to Practice*, Erlbaum Associates, 1986

Semester: 1
Teaching Unit: UED 1.1
Course: Automatics and Control Systems
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Automatics are a field comprising mathematical theories and reasoning techniques related to decision-making and system control. Originally focused on the study of mechanical and electromechanical systems, this discipline is now applied in fields such as economics, chemistry, biology, and more. This mandatory course aims to provide Master's students with a set of mathematical tools and basic concepts in the control of dynamic, linear, and continuous systems.

Recommended Prerequisites

(Not specified, but likely to include mathematics and basic physics)

Course Content

Chapter 1: General Concepts

Chapter 2: About Systems

- 2.1 Types of Systems
    - 2.1.1 Continuous-time and discrete-time systems
    - 2.1.2 Single-variable and multi-variable systems
    - 2.1.3 Stationary systems
    - 2.1.4 Linear and non-linear systems
- 2.2 Representation of Linear Time-Invariant Systems
    - 2.2.1 Differential equations and transfer functions
    - 2.2.2 Time-domain representations
    - 2.2.3 Frequency-domain representations
    - 2.2.4 State-space representation

Chapter 3: Stability
Chapter 4: Control

- 4.1 Open-loop control
- 4.2 Closed-loop systems
- 4.3 Example of a control loop
- 4.4 Different control techniques

Assessment Method

Final exam: 100%

Environmental Awareness and Fundamentals
Semester 1
Teaching Unit: UE Discovery Code UED 1.1
Total Hours: 22 h 30 (Lectures 1h30)
Credits: 1
Coefficient: 1

Course Objectives:

- Introduce students to basic concepts of ecology and environmental protection in urban contexts.
- Raise awareness of the environmental impacts of hydraulic and urban development projects.
- Integrate environmental considerations into the design, management, and operation of hydraulic infrastructure.

Course Content:

1. General Introduction to Environment

- Definitions: environment, sustainable development, ecosystems
- Human pressures and environmental challenges

2. Basics of Ecology

- The water cycle and its disruption due to urbanization
- Aquatic ecosystems: rivers, wetlands, coastal zones
- Indicators of ecological and environmental quality

3. Water Pollution in Urban Areas

- Pollution sources (domestic, industrial, stormwater)
- Impact of wastewater and uncontrolled discharges
- Key pollution parameters (BOD, COD, TSS, nutrients, etc.)

4. Environmental Impact Assessment and Risk Management

- Environmental Impact Assessment (EIA) methodology
- Environmental risk analysis
- Mitigation and prevention measures

5. Environmental Regulations and Policies

- National and international environmental regulations
- Legal frameworks related to water (e.g., WHO standards, EU directives)
- Institutional actors in environmental protection

6. Integrating the Environment into Hydraulic Projects

- Ecological engineering and sustainable planning
- Case studies: integration of environmental aspects in sanitation and water supply projects
- Nature-based solutions in cities: stormwater management using green infrastructure (swales, retention basins, green roofs, etc.)

Assessment Methods:

- Continuous assessment : **100%**

Semester:2
Teaching Unit: UEF 1.2.1
Subject 1: Hydraulic Structures
Total Hours: 45h (Lecture: 1h30, Tutorial: 1h30 per week)
Credits: 4
Coefficient: 2

Course Objectives:

Dam developments are often complex and require multidisciplinary teams for their study, construction, and operation. The objective of this unit is to provide the basic tools necessary for the design, construction, and operation of dams, while building upon the concepts taught in the "Hydraulic Structures" course from Semester 6 of the Hydraulic Engineering bachelor's program.

Recommended Prerequisites:

- Hydrology
- Geology and Hydrogeology
- SoilMechanics
- Strength of Materials

Course Content:

- **Chapter 1: Preliminary studies for dam construction (3 Weeks)**
  1.1 Site selection
  1.2 Topographic study
  1.3 Geological and geotechnical study
  1.4 Hydrological study
- **Chapter 2: Earth Dams (4 Weeks)**
  2.1 Typology of earth dams
  2.2 Seepage analysis
  2.3 Stability analysis
  2.4 Protective devices against water effects (filters and drains)
- **Chapter 3: Concrete Dams (4 Weeks)**
  3.1 Typology of concrete dams
  3.2 Actions and forces acting on concrete dams
  3.3 Stability of gravity dams
  3.4 Stability of buttress dams
  3.5 Stability of arch dams
- **Chapter 4: Functional and Auxiliary Hydraulic Structures (3 Weeks)**
  4.1Flood spillways
  4.2 Intakes and bottom outlets
  4.3 Diversion systems during construction
  4.4 Reservoirs and water towers

Evaluation Method:

Continuous assessment: 40%

Final exam: 60%

References:

6. *P. Gourdault Montagne, 1994, Le droit de riveraineté, propriétés, usages, protection descours d'eau..., Edition Tec et doc*
7. *G. Degoutte, Petits barrages recommandations pour la conception, la réalisation et lesuivi. Cemagrefedition, France 2002*
8. *N. Kremenetski, D. Schterenliht, V. Alychev, L.Yakovleva, Hydraulique, Mir 1984*
9. *Marc Soutter, André Mermoud, AndreMusy , 2007, Ingénierie des eaux et du sol,Processus et aménagements, Edition Presses Polytechniques et Universitaires Romandes(PPUR)*
10. *Richard Mc. Cuen, 2004, Hydrologic Analysis and Design, Edition Pearson Education ,Prentice Hall*
11. *R. Thérond, 1973, Recherche sur l'étanchéité des lacs de barrage en pays karstique,Edition EDF*
12. *Rolley, R., H. Kreitmann, J. Dunglas, A. Pierrejean and L. Rolland, 1977, Technique desbarrages en aménagement rural. Ministère de l'agriculture, Paris, France. -*

Semester: 2
Teaching Unit: UEF 1.2.2
Subject: Hydraulic Machines and Pumping Stations
Total Hours: 45 hours (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Objectives of the Course:

- Acquire knowledge about the equipment upstream and downstream of a pumping station
- Know the different types of pumping stations
- Choose the type of pumping station
- Know how to solve the cavitation problem that affects pumps
- Master the placement of pumps in non-cavitation zones
- Types of pumping stations
- Learn to design pumping stations
- Learn to operate the hydro-energy and hydraulic works and equipment of the pumping station
- Acquire theoretical and practical knowledge on the construction and operating principles of Pelton, Francis, and Kaplan turbines.

Recommended Prerequisites:

- Basics of hydrology and climatology
- Applied statistics
- Use of computer tools.

Content of the Course:

CHAPTER I: REMINDERS ON PUMPS (1 Week)

CHAPTER II: COUPLING PUMPS IN SERIES AND IN PARALLEL (3 Weeks)

II-1 Identical and non-identical pumps in series
II-2 Identical and non-identical pumps in parallel
II-3 Operating point
II-4 Adjustment of the operating point
II-5 Study of different variants of the operating point

CHAPTER III: CLASSIFICATION AND MAINTENANCE OF PUMPING STATIONS (4 Weeks)

III-1 Introduction
III-2 Sizing of pumping stations
III-3 Possible incidents
III-4 Different ways of troubleshooting

CHAPTER IV: LAWS OF SIMILARITY IN INCOMPRESSIBLE FLUID PUMPS (2 Weeks)

IV-1 Introduction
IV-2 Reminder of similarity
IV-3 Theoretical study of similarity
IV-4 Determination of specific speed
IV-5 Influence of rotational speed on pump characteristics
IV-6 Influence of wheel diameter on pump characteristics
IV-7 Classification of blade pumps according to their specific speed

CHAPTER V: STUDY OF CAVITATION IN PUMPS (2 Weeks)

V-1 Phenomenon of cavitation
V-2 Causes and consequences of cavitation
V-3 Theoretical study of cavitation
V-4 Admissible suction height
V-5 NPSH for a pressurized and depressurized installation

CHAPTER VI: HYDRAULIC TURBINES (3 Weeks)

VI-1 Introduction
VI-2 Role of turbines in hydraulics
VI-3 Classification of turbines
VI-4 Pelton turbine
VI-5 Francis turbine
VI-6 Kaplan turbine
VI-7 Hydroelectric station

Evaluation Method:

Continuous assessment: 40%; exam: 60%.

Bibliographic References:

1. *Pumps and Pumping Stations. Author(s): SAVATIER - 01-1994 - Paperback*
2. *History of Hydraulic Energy: Mills, Pumps, Wheels, and Turbines from Antiquity to the 20th Century. Author(s): VIOLLET Pierre-Louis*
3. *One-Dimensional Hydraulics Part 2: Water Hammer and Mass Oscillation Phenomenon. Centrifugal Pumps. Author(s): PERNÈS Pierre*
4. *NF ISO 17559: Hydraulic transmissions, electrically controlled hydraulic pumps. 06-2004 - 28p. Paperback*
5. *Pumps. Selection Manual, Application to Variable Speed. (Tech. Coll., Ref. MD1 PUMPS). Author(s): MANON Jean - 01-2002 - 260p. 21x29.6 Paperback*
6. *NF EN 23661: Centrifugal pumps with end suction, dimensions related to bases and installation. Author(s): NF EN 23661 - 12-1993 - Bound*
7. *NF EN ISO 5198: Centrifugal, helico-centrifugal, and screw pumps. Hydraulic performance test code, precision class. Author(s): NF ISO 5198 - 12-1987 - Bound*

Semester: 2
Teaching Unit: UEF 1.2.2
Subject: GROUNDWATER HYDRAULICS
Total Hours: 45h00 (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching Objectives

The first part of this course lays out the theoretical and experimental foundations of groundwater hydraulics and discusses the various assumptions leading to the fundamental equations. The second part deals with specific cases of underground flows commonly encountered in hydraulic and civil engineering works, such as flows through underground cavities, leakage or supply flows in trenches and canals, dewatering of excavations and cofferdams, flows under dam foundations or through dikes, etc.

Recommended Prerequisites

- Mathematics
- General Hydraulics
- Hydrogeology

Course Content

Part 1 – Physical and Theoretical Foundations of Groundwater Hydraulics (7 weeks)

- Flow through porous media. Darcy's law
- Generalization of Darcy's law
- Permeability
- Flow through fractured media
- Steady-state flows following Darcy's law – Equations and general concepts
- Transient flows following Darcy's law – Equations and general concepts
- The action of interstitial water on porous media

Part 2 – Practical Problems in Groundwater Hydraulics (8 weeks)

- General methods for solving steady-state flow problems
- General methods for solving transient flow problems
- Well hydraulics
- Well groups
- Drains and catchments
- Dikes and dams
- Cutoff walls and cofferdams
- Dewatering and excavations
- Permeability measurements

Assessment Method

- Continuous assessment: 40%
- Final exam: 60%

References

1. *G. Schneebeli (1987). Groundwater Hydraulics. Publisher: Eyrolles. 362 pages.*
2. *Cassan (1994). AIDE-MEMOIRE D'HYDRAULIQUE SOUTERRAINE. Publisher: Presses de l'École Nationale des Ponts et Chaussées. 193 pages.*
3. *Lohman S.W. (1972). Groundwater Hydraulics. Publisher: US Geological Survey. Free access: https://pubs.usgs.gov/pp/0708/report.pdf*

Semester: 2
Teaching Unit: UEF 1.2.1
Subject: Water Treatment and Desalination
Workload: 67h30 (Lecture: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Course Objectives:

The student will learn the processes of water treatment and desalination, the operating principles of treatment facilities, as well as the basic design calculations. This course complements what was covered in the "Water Treatment and Purification" subject taught in the fifth semester of the Hydraulic Engineering bachelor's program.

Recommended Prior Knowledge:

- Basics of water chemistry
- Fundamental concepts of general hydraulics

Course Content:

Chapter I: Generalities and Standards ***(1 week)***

- Water quality from various sources
- Water composition: dissolved elements, colloidal matter, suspended solids – sources, effects, and removal
- Standards for drinking water (Algerian, WHO, etc.), irrigation water, and industrial water

Chapter II: Coagulation/Flocculation ***(2 weeks)***

- Colloids characteristics, stability factors, double-layer model, zeta potential
- Coagulation: phenomenon, implementation, mixing intensity
- Flocculation: perikinetic, orthokinetic, implementation, jar test

Chapter III: Sedimentation ***(2 weeks)***

- Discrete particle sedimentation: ideal basin, design of horizontal/vertical flow settlers
- Flocculent sedimentation: column test, design
- Sludge blanket clarifiers, tube and lamella settlers

Chapter IV: Filtration ***(2 weeks)***

- Properties of filter media (chemical, physical)
- Filtration mechanisms: straining, settling, adsorption, surface reactions, biological activity
- Flow through filters: Carman-Kozeny equation
- Rapid sand filters: characteristics, operation, backwashing, design
- Slow sand, pressure, and diatomaceous earth filters: descriptions and designs
- Activated carbon filters: powdered/granular carbon, adsorption properties and kinetics

Chapter V: Disinfection ***(2 weeks)***

- Principles (Chick's Law, influence of contact time, concentration, temperature)
- Disinfection by chlorine (chemistry, breakpoint chlorination, dechlorination)
- Disinfection by chlorine dioxide, ozone, ultraviolet

Chapter VI: Softening and Metal Removal ***(2 weeks)***

- Hardness origin and types, expression of hardness
- Softening by precipitation (lime only, lime + soda, excess lime, etc.)
- Removal of iron and manganese, fluoridation/defluoridation, removal of pollutants (nitrates, sulfides, arsenic...)

Chapter VII: Desalination of Seawater and Brackish Water ***(2 weeks)***

- Generalities: water characteristics, terminology, desalination processes (electrodialysis, reverse osmosis, distillation, evaporation, nuclear and solar desalination)
- Reverse osmosis: membranes, pressure, conversion rate, polarization, design
- Electrodialysis: process, membranes, polarization, design
- Distillation: single and multi-effect, multi-flash evaporation
- Solar distillation: design, performance prediction, economics

Chapter VIII: Scaling and Corrosion in Water Supply and Desalination Systems ***(1 week)***

- Scaling: composition, influencing factors, calcium carbonate precipitation
- Anti-scaling methods: acid treatment, ion exchange, CO_2 injection, inhibitors, pH control
- Corrosion: types, electrochemical aspects, corrosion rate
- Anti-corrosion methods: cathodic/anodic protection, inhibitors
- Monitoring of scaling and corrosion

Chapter IX: Control Methods for Unit Processes ***(1 week)***

- Automated water quality monitoring: pH, conductivity, turbidity, oxidant electrode potentials, radioactivity
- Specific tests: jar test, filterability, inorganic analysis, zeta potential, electrophoretic mobility, colloid titration, particle counting, sludge cohesion index, sludge settling, shear resistance, capillary suction time, filterability, sludge compressibility and dryness

Course Project:

- Design of a water treatment plant
- Design of a desalination plant

Evaluation Method:

- Continuous assessment: 40%
- Final exam: 60%

Semester: 2
Teaching Unit: UEM 1.2
Subject: Lab – Hydraulic Machines and Pumping Stations
Total Hours: 22h30 (Lab: 1h30)
Credits: 2
Coefficient: 1

Teaching Objectives
The objectives assigned to this subject focus on initiating students to apply the theoretical knowledge acquired in the courses on hydraulic machines and pumping stations.

Recommended Prerequisite Knowledge
General hydraulics, hydraulic machines, pumps, and pumping stations.

Course Content

- **Lab 1:** Characteristics of a centrifugal pump (head, power, and efficiency)
- **Lab 2:** Series pump setup (head, power, and efficiency)
- **Lab 3:** Parallel pump setup (head, power, and efficiency)
- **Lab 4:** Francis / Pelton turbine
- **Lab 5:** Cavitation

Assessment Method:
Continuous assessment: 100%

Semester: 2
Course Unit: UEM 2.1
Subject: Lab Work on Water Treatment and Purification
Total Hours: 22h30 (Lab: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

The objective of this course is to initiate students into the practical application of theoretical knowledge acquired in wastewater treatment courses. The student will be able to use bench-scale measuring instruments as well as pilot systems designed to conduct water purification studies.

Recommended Prerequisite Knowledge

- Water chemistry
- Water biology
- Water treatment
- Water purification

Course Content

TP1: Measurement of Suspended Solids (SS)	(2 weeks)
TP2: Measurement of Volatile Suspended Solids (VSS) –	(2 weeks)
TP3: Determination of Biochemical Oxygen Demand (BOD5)	(2 weeks)
TP4: Determination of Chemical Oxygen Demand (COD)	(2 weeks)
TP5: Total Kjeldahl Nitrogen (TKN) and Total Phosphorus (TP)	(3 weeks)
TP6: Determination of the Mohlman Index (MI)	(2 weeks)

Assessment Method

Continuous assessment: 100%

References

1. J. Rodier, Water Analysis, Ed. Dunod

Modeling and Simulation in Hydraulics
Semester: 2
Teaching Unit: UEM 1.2
Workload: 37h30 (including 2h30 of practical work)
Credits: 3
Coefficient: 2

Course Objectives

To enable students to numerically solve mathematical equations governing hydraulic problems and fundamental practical issues by developing simplified programs using Matlab (or other environments) and simulating real (complex) cases with appropriate software.

Recommended Prerequisites

- Good knowledge of fluid mechanics fundamentals
- Understanding of pressurized and free surface flows
- Familiarity with numerical methods and programming languages

Course Content

Chapter 1: Review *(1 week)*

(Numerical methods for solving nonlinear equations and systems of equations)

- Bisection Method, Secant Method, Regula Falsi Method, Newton-Raphson Method, Fixed Point Method
- Methods for solving systems of equations (direct and iterative methods)

Chapter 2: Modeling of Flows Using the Finite Difference Method (FDM) *(2 weeks)*

- Discretization of differential operators
- Introduction of boundary and initial conditions
- First-order and second-order finite differences
- Temporal discretization schemes (explicit, implicit, and mixed)
- Convergence, stability, and accuracy of numerical schemes
- Application example: steady uniform flow modeling using FDM

Chapter 3: Modeling of Flows Using the Finite Element Method (FEM) *(2 weeks)*

- Meshing and elements
- Error minimization methods (weighted residuals, Galerkin, etc.)
- Nodal approximations
- Reference elements
- Weak integral methods
- Element calculations and numerical integration
- Application example: steady uniform flow modeling using FEM

Chapter 4: Introduction to the Finite Volume Method ***(1 week)***

- Introduction and discretization methods
- Heat equation (conduction, convection, diffusion)
- Application example

Chapter 5: Flow Modeling and Simulation ***(9 weeks)***

- Unsteady free surface flow in a 1D prismatic channel
- Transient pressurized flow in a 1D pipe
- Backwater curve computation (software use)
- Reservoir (dam) draining into the atmosphere
- Flow between two reservoirs (dams)
- Simulation of flows in water supply, sewer, irrigation, and drainage networks
- Additional simulations...

Assessment Method

- Continuous assessment: 100%

Flood Forecasting and Flood Risk Management
Semester: 2
Teaching Unit:
Workload:
Credits:
Coefficient:

Objectives:
To acquire the fundamental concepts required to understand and describe the hydrological functions of watersheds and to master the techniques currently used to mitigate flood risks.

Course Content:
Chapter 1: Overview of the Hydrological Cycle
1.1 The hydrological cycle of a watershed
1.2 Hydrological system of watercourses: average flow, low water, flooding
1.3 Modeling of runoff processes

Chapter 2: Frequency Analysis
2.1 Data analysis and evaluation
2.2 Calculation of flow values and reference hydrograph

Chapter 3: Probabilistic Estimation of Extreme Flood Events
3.1 Simplified probabilistic models: Gradex and aggregate methods
3.2 Rainfall-runoff models
3.3 Use of historical information
3.4 Estimation at ungauged sites: summarized methods, QDF curves, regional mapping approaches

Chapter 4: Flood Risk Management
4.1 Flood forecasting and early warning
4.2 Flood risk prevention
4.3 Risk issues: hazard/vulnerability
4.4 Different protective measures and their effects: flood susceptibility method

Chapter 5: Human Impacts on Flood Risk
5.1 Effects of land-use planning
5.2 Effects of protective and retention structures
5.3 Detection of trends in observed data series

Chapter 6: Flood Protection
6.1 Watershed management
6.2 Construction of barriers
6.3 Management of major river channels

Course Program: Sustainable Agriculture and Territorial Development
Semester: 2
Teaching Unit:
Workload:
Credits:
Coefficient:

Chapter 1: Introduction to Sustainable Agriculture
- Fundamental concepts of sustainable agriculture
- Sustainable agricultural practices

Chapter 2: Hydraulics and Water Management
- Principles of hydraulics
- Water resource management for agriculture

Chapter 3: Rural Economy and Sustainable Development
- Economic models for sustainable agriculture
- Impact of agriculture on territorial development

Chapter 4: Sustainable Cropping Systems
- Environmentally friendly farming techniques
- Agroecology and crop diversification

Chapter 5: Agricultural and Environmental Policies
- Role of public policies in agricultural sustainability
- Environmental regulations

Chapter 6: Soil Management and Fertility
- Soil conservation techniques
- Improvement of soil fertility

Chapter 7: Information and Communication Technologies in Agriculture
- Use of ICTs for sustainable agriculture
- Geographic Information Systems (GIS) for resource management

Chapter 8: Climate Change and Agriculture
- Impact of climate change on agriculture
- Adaptation and mitigation strategies

Chapter 9: Territorial Development Projects
- Development of sustainable development projects
- Case studies on successful initiatives

Assessment

100% Final Exam

Semester: 2
Course Unit: UEM 1.2
Subject: ORGANIZATION AND MECHANIZATION OF WORKS
VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Objectives of the Course

The objectives assigned by this subject focus on introducing students to the various actions necessary for the organization and mechanization of hydraulic construction sites.

Recommended Prerequisite Knowledge

Applied hydraulics, sanitation, hydraulic structures.

Course Content

Chapter 1: Common Vocabulary (2 Weeks)

1.1. Construction site

1.2. Definitions and Differences between Project Manager and Project Owner

1.3. Contracts and Legal Aspects

Chapter 2: Site Installation (4 Weeks)

2.1. Preparatory Works
2.2. Clearing Areas
2.3. Sanitation, Hydraulic Protections, and Networks
2.4. Signage – Supports
2.5. Marking and Layout
2.6. Preliminary Work Schedule
2.7. Execution Phasing
2.8. Site Installations

Chapter 3: Earthworks (3 Weeks)

3.1. General Earthworks
3.2. Bulk Earthworks
3.3. Excavation Earthworks
3.4. Trench Earthworks
3.5. Protection and Shoring
3.6. Lowering Water Tables and Drainage

Chapter 4: Pipe Installation (4 Weeks)

4.1. Criteria for Choosing Pipes Based on Soil Nature
4.2. Excavation for Pipes
4.3. Backfilling for Pipes
4.4. Handling of Pipes
4.5. Installation and Assembly Techniques
4.6. Leak Testing and Acceptance of Works
4.7. Quality Control

Chapter 5: Hydraulic Concrete (3 Weeks)

5.1. General Indications
5.2. Consistency of Concrete
5.3. Mix Ratios and Compositions

5.4. Strength of Concrete
5.5. Choice of Composition Materials
5.6. Concrete Manufacturing
5.7. Transport, Handling, and Workability
5.8. Admixtures
5.9. Tests and Inspections

Evaluation Method:
Exam: 100%

Semester: 2
Teaching Unit: UET 1.2
Subject: ETHICS, DEONTOLOGY, AND INTELLECTUAL PROPERTY
Total Hours: 22h30 (Course: 1h30)
Credit: 1
Coefficient: 1

Teaching Objectives:

To raise students' awareness of ethical principles. To introduce them to the rules governing university life (their rights and obligations towards the university community) and in the workplace. To sensitize them to the respect and appreciation of intellectual property. To explain the risks of moral evils such as corruption and how to combat them.

Recommended Prerequisites:
None

Course Content:
A- Ethics and Deontology
I. Concepts of Ethics and Deontology (3 weeks)

- Introduction
    - Definitions: Morality, Ethics, Deontology
    - Distinction between ethics and deontology
- Charter of Ethics and Deontology of MESRS: Integrity and honesty. Academic freedom. Mutual respect. Demand for scientific truth, Objectivity, and critical spirit. Equity. Rights and obligations of students, teachers, administrative and technical staff.
- Ethics and deontology in the workplace
    - Legal confidentiality in companies. Loyalty to the company. Responsibility within the company, Conflicts of interest. Integrity (corruption in work, its forms, consequences, modes of struggle, and sanctions against corruption)

II. Responsible and Integrity Research (3 weeks)

- Respect for ethical principles in teaching and research
- Responsibilities in teamwork: Equal professional treatment. Conduct against discrimination. The pursuit of general interest. Inappropriate behaviors in collective work
- Adopting responsible conduct and combating deviations: Adopting responsible conduct in research. Scientific fraud. Conduct against fraud. Plagiarism (definition of plagiarism, different forms, procedures to avoid unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.

B- Intellectual Property
I- Fundamentals of Intellectual Property (1 week)

- Industrial property. Literary and artistic property.
- Rules for citing references (books, scientific articles, conference communications, theses, dissertations, etc.)

II- Copyright **(5 weeks)**

- Copyright in the digital environment
- Introduction. Copyright of databases, copyright of software. Specific case of free software.
- Copyright on the internet and e-commerce
- Domain name rights. Intellectual property on the internet. Rights of e-commerce sites. Intellectual property and social networks.
- Patents
- Definition. Rights in a patent. Usefulness of a patent. Patentability. Patent application in Algeria and worldwide.
- Trademarks, designs, and models
- Definition. Trademark law. Law of designs and models. Appellations of origin. Trade secrets. Counterfeiting.
- Law of Geographical Indications
- Definitions. Protection of Geographical Indications in Algeria. International treaties on geographical indications.

III- Protection and Enhancement of Intellectual Property **(3 weeks)**

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

Evaluation Method:

Exam: 100%

Bibliographic References:

1. *Charter of University Ethics and Deontology,*
2. *Decree No. 933 of July 28, 2016, setting rules for preventing and combating plagiarism*
3. *The ABC of Copyright, United Nations Educational, Scientific and Cultural Organization (UNESCO)*
4. *E. Prairat, On Teacher Deontology. Paris, PUF, 2009.*
5. *Racine L., Legault G. A., Bégin, L., Ethics and Engineering, Montreal, McGraw Hill, 1991.*
6. *Siroux, D., Deontology: Dictionary of Ethics and Moral Philosophy, Paris, Quadrige, 2004, pp. 474-477.*
7. *Medina Y., Deontology: What Will Change in the Company, Editions d'Organisation, 2003.*
8. *Didier Ch., Thinking the Ethics of Engineers, Presses Universitaires de France, 2008.*
9. *Gavarini L. and Ottavi D., Editorial. Professional Ethics in Training and Research, Research and Training, 52 | 2006, 5-11.*
10. *Caré C., Morality, Ethics, Deontology. Administration and Education, 2nd quarter 2002, no. 94.*
11. *Jacquet-Francillon, François. Notion: Professional Deontology. Le Télémaque, May 2000, no. 17*
12. *Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.*

13. *Galloux, J.C., Industrial Property Law. Dalloz 2003.*
14. *Wagret F. and J-M., Invention Patents, Trademarks, and Industrial Property. PUF 2001*
15. *Dekermadec, Y., Innovate with Patents: A Revolution with the Internet. Insep 1999*
16. *AEUTBM. The Engineer at the Heart of Innovation. University of Technology Belfort-Montbéliard*
17. *Fanny Rinck and Léda Mansour, Literacy in the Digital Age: Copy-Paste among Students, University of Grenoble 3 and University of Paris-West Nanterre La Défense, France*
18. *Didier DUGUEST IEMN, Citing Your Sources, IAE Nantes 2008*
19. *Similarity Detection Software: A Solution to Electronic Plagiarism? Report of the Working Group on Electronic Plagiarism presented to the Subcommittee on Pedagogy and ICT of CREPUQ*
20. *Emanuela Chiriac, Monique Filiatrault, and André Régimbald, Student Guide: Intellectual Integrity, Avoiding Plagiarism, Cheating, and Fraud, 2014.*
21. *University of Montreal Publication, Strategies for Preventing Plagiarism, Integrity, Fraud, and Plagiarism, 2010.*
22. *Pierrick Malissard, Intellectual Property: Origin and Evolution, 2010.*

Semester 3
Teaching Unit : UEF 2.1.2
Module : RIVER ENGINEERING AND SEDIMENT TRANSPORT
Total Hours :45h00 (Cours : 1h30, TD : 1h30)
Credits :4
Coefficient :2

Course Objective

The objective of this course is to provide students with an in-depth understanding of the mechanisms related to soil erosion and sediment transport. These phenomena play a crucial role in watershed dynamics and represent a major issue due to their impacts, particularly the gradual siltation of dams, which compromises their optimal functioning.

Prerequisite Knowledge

- Based on geology
- Based on watershed hydrology

Course Content

Chapter 1 : Modes of transport **(1 week)**

Chapter 2 : Solid load measurement techniques **(2 weeks)**

Chapter 3 : Transport formulas and quantification of solid inputs (gauged and ungauged rivers) **(3 weeks)**

Chapter 4: Physical and ecological role of rivers **(2 weeks)**

Chapter 5: Various types/techniques of riverbank stabilization. Torrent correction **(3 weeks)**

Chapter 6: Soil management and control of water erosion **(2 weeks)**

Chapter 7: Overview of the environmental impact of developments **(2 weeks)**

Evaluation Method :

Continuous assessment + final exam

Bibliographic References

1. Degoute. G. transport solide en hydraulique fluviale. Document Cemegraf.2002.

2. Recking. A. Cours d'hydraulique et de transport solide. Paris 6.2012

Semester: 3
Teaching Unit: UEF 2.1.1
Subject: Wastewater Treatment and Reuse
Total Hours (VHS): 45 hours (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

This course introduces students to techniques for treating liquid effluents, the operation of biological reactors, and the basic principles of designing wastewater treatment structures. It also covers the reuse of treated wastewater in agriculture, including both the benefits and constraints associated with this practice.

Recommended Prerequisites:

- Basic chemistry
- Fundamental concepts in general hydraulics

Course Content:

PART 1: WASTEWATER TREATMENT

Chapter I: Review of Microbiology Basics

Chapter II: Pollution Parameters in Wastewater and Discharge Standards

- General overview of wastewater pollution parameters
- Evaluation of wastewater flow rates and pollutant loads
- Discharge standards

Chapter III: Mechanical Treatment of Wastewater

- Screening
- Sand and oil removal

Chapter IV: Biological Treatment of Wastewater

- Fundamental principles of biological treatment
- Definition of biological phenomena
- Study of aerobic metabolism
- Study of anaerobic metabolism
- Biological treatment with fixed biomass
- Biological treatment with suspended biomass

Chapter V: Sludge Treatment

PART 2: REUSE OF TREATED WASTEWATER

Chapter I: Wastewater and Reuse Techniques

- Composition of wastewater
- Treatment and storage of wastewater
- Irrigation

Chapter II: Regulatory Aspects of Wastewater Reuse in Irrigation

- Chemical constraints (salinity, heavy metals)

- Microbiological constraints (pathogens, etc.)

Chapter III: Project Development Techniques for Reuse of Treated Wastewater

- Evaluation of water resources and needs
- Sanitation status
- Wastewater market analysis
- Scenario analysis

Assessment Method:

Written exam + Continuous assessment

References:

J.R. Tiercelin, A. Vidal, Traité d'Irrigation, Editions Tec & Doc Lavoisier, 1350 pages, 2006.

Urban Water Distribution and Collection

Semester: 3
Teaching Unit: UEF 2.1.1
Subject: Urban Water Distribution and Collection
Total Hours: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

The aim of this course is to provide students with a comprehensive understanding of urban water networks, including their components, sizing, modeling, and protection.

Prerequisite Knowledge

- Fluid Mechanics
- General Hydraulics
- Hydrology
- Mathematics
- Urban Hydraulics

Course Content

Part I: Drinking Water Supply

Chapter I: Potable Water Supply
Chapter II: Design and Sizing of Distribution Networks
Chapter III: Modeling and Calibration of Potable Water Supply Systems
Chapter IV: Protection of Infrastructure
Chapter V: Diagnostic Methodology for Potable Water Networks
Chapter VI: Pipework Technology
Chapter VII: Management and Remote Management of Water Networks

Part II: Urban Sanitation

Chapter I: Hydrological Phenomena and Modeling – Concepts of urban hydrology, IDF curve development, calculation of stormwater flows
Chapter II: Design and Sizing of Sanitation Networks – Design of stormwater and urban wastewater networks
Chapter III: Urban Sanitation Structures
Chapter IV: Alternative Techniques in Stormwater Sanitation – Principles and Design
Chapter V: On-site Sanitation
Chapter VI: Diagnostic Methodology for Urban Sanitation Networks
Chapter VII: Impacts of Urban Discharges on the Receiving Environment
Chapter VIII: Mathematical Models Used in Urban Sanitation

Assessment Method

Continuous assessment + final exam

References

1. *François G. Brière, Distribution et collecte des eaux, Presses Inter Polytechnique*

2. *A. Dupon, Hydraulique urbaine, Volumes 1, 2, and 3*
3. *J. Bonnin, Hydraulique urbaine appliquée aux petites et moyennes agglomérations*
4. *F. Varilon, Mémento de l'exploitant d'eau et d'assainissement*
5. *Marc SATIN, Béchir SELMI, Guide technique de l'assainissement, Le Moniteur, Paris, 1995*
6. *François VALIRON, Mémento du gestionnaire de l'alimentation en eau potable et de l'assainissement, Lavoisier TEC & DOC, Volumes 1, 2, and 3, Paris, 1994*
7. *Mackenzie L. DAVIS, David A. CORNWELL, Introduction to Environmental Engineering , 3rd Edition, USA, 1998*
8. *Bernard CHOCAT, Encyclopédie de l'hydrologie urbaine et de l'assainissement, Lavoisier TEC & DOC, Paris, 1997*

Semester: 3

Teaching Unit: UEF 2.1.2
Subject: Exploration and Drilling Techniques
Class Hours: 22h30 (Lectures: 1h30)
Credits: 2
Coefficient: 1

Teaching Objectives

The student is expected to acquire knowledge about the process of drilling a water well, from site selection to the drilling equipment used.

Recommended Prerequisite Knowledge

Basic knowledge in geology and the mechanics of rocks and fluids is recommended.

Course Content

Chapter 1: Exploration and Reconnaissance (2 weeks)

1.1 Cartography

1.2 Geophysical methods

1.3 Reconnaissance drilling (boreholes)

Chapter 2: Drilling Techniques (2 weeks)

2.1 Percussion drilling technique

2.2 Rotary drilling technique

2.3 Reverse circulation rotary drilling technique

2.4 Down-the-hole hammer technique (DTH)

2.5 ODEX technique

2.6 Auger drilling technique

Chapter 3: Drilling Fluids (Drilling Mud) (2 weeks)

3.1 Role of drilling fluids

3.2 Drilling mud

3.3 Compressed air

3.4 Stabilized foam

3.5 Drilling fluid circuits

3.6 Recommendations for the use of drilling fluids

Chapter 4: Drilling Equipment (2 weeks)

4.1 Casings and Screens

4.2 Filter pack (gravel pack)

4.3 Well cementing

Chapter 5: Drilling Implementation (2 weeks)

5.1 Setting up the drilling site

5.2 Choosing the drilling technique

5.3 Casing installation

5.4 Straightness and verticality control

5.5 Mud pits

Semester 3 - Practical Work in Water Treatment and Purification
Teaching Unit: UEM 2.1
Subject: Practical Work in Water Treatment and Purification
Total Hours: 22h30 (Practical: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

The objectives assigned to this course focus on introducing students to the practical application of theoretical knowledge acquired in the water treatment course, particularly for wastewater treatment. Students will be able to use bench-scale measuring instruments as well as pilot equipment designed to conduct water purification studies.

Recommended Prerequisite Knowledge

- Water Chemistry
- Water Biology
- Water Treatment
- Wastewater Treatment

Course Content

TP1: Measurement of Suspended Solids (SS)	**(2 weeks)**
TP2: Measurement of Volatile Suspended Solids (VSS)	**(2 weeks)**
TP3: Determination of Biochemical Oxygen Demand (BOD5)	**(2 weeks)**
TP4: Determination of Chemical Oxygen Demand (COD)	**(2 weeks)**
TP5: Total Kjeldahl Nitrogen (TKN) and Total Phosphorus (TP)	**(3 weeks)**
TP6: Determination of the MOHLMAN Index (MI)	**(2 weeks)**

Assessment Method

Continuous assessment: 100%

Bibliographic References

1. J. Rodier, Water Analysis, Ed. Dunod

Semester: 3
Course Unit: UEF 2.1.1
Subject: Preservation and Protection Against Floods and Inundations
Course Hours: 22h30 (Lecture: 1h30)
Credits: 2
Coefficient: 1

Teaching Objectives:

To enable a better understanding of the objectives of hydrological studies related to the design and dimensioning of protection works in urban areas against floods and inundations. This is done based on the acquisition of fundamental elements in the field, and applying them to the design and resolution of constraints related to floods in urban environments.

Recommended Prerequisites:

Basics of hydrology and general hydraulics

Course Content:

Chapter 1: Fundamental reminders on basic hydrology. **(1 Week)**
Chapter 2: Data presentation and analysis. **(2 Weeks)**
Chapter 3: Study of precipitation series. **(2 Weeks)**
Chapter 4: Study of flood series. **(2 Weeks)**
Chapter 5: Flood frequency and variance analysis. **(2 Weeks)**
Chapter 6: Types of floods, typology of floods. **(1 Week)**
Chapter 7: Flood analysis, flood typologies, recalendarization of watercourses. **(2 Weeks)**
Chapter 8: Urban area flooding. **(2 Weeks)**
Chapter 9: Management and operation of protection works. **(2 Weeks)**

Assessment Method:

100% Final Exam

Bibliographic References:

1. *Coste, C. & Coudert, M., 1988, Guide to sanitation in urban and rural environments, Eyrolles Publishing.*
2. *Valentina, J., 1972, Sanitation works, Eyrolles Publishing.*
3. *Bourier, R., 1992, Sanitation networks, Edition TEC & DOC.*
4. *Bennis, S., 2007, Hydraulics and Hydrology, Multimodes Publishing.*

Semester: 3
Teaching Unit: UEM 2.1
Subject: Specialized Software
Total Semester Hours (TSH): 37.5 hours *(Practical Work: 2h30 per week)*
ECTS Credits: 3
Coefficient: 2

Course Objectives:
This course aims to enable students to master hydrological modeling software and to conduct a measurement campaign for calibrating and validating modeling results.

Recommended Prerequisites:
Students should have knowledge in fundamental subjects such as mathematics, fluid dynamics, hydrology, and computer science.

Course Content:

Chapter 1: Modeling: Concepts and Approaches	**(2 weeks)**
Chapter 2: Objectives of Hydrological Phenomenon Modeling	**(2 weeks)**
Chapter 3: Definition of a Hydrological Model	**(2 weeks)**
Chapter 4: Different Types of Models	**(2 weeks)**
Chapter 5: Main Stages of Modeling	**(2 weeks)**
Chapter 6: Presentation of Used Modeling Software	**(2 weeks)**
Chapter 7: Construction of the Physical Model of the Network	**(2 weeks)**
Chapter 8: Measurement Campaign and Model Calibration	**(2 weeks)**
Chapter 9: Coupling GIS with Different Hydrological Models	**(2 weeks)**

Assessment Method:
Continuous Assessment: 100%

Bibliographic References:

1. *Blain, W. R. (2000). Hydraulic Engineering Software VIII (Wessex Ins). Retrievedfrom*https://www.witpress.com/books/978-1-85312-814-1

2. *Hager, W. H., Schleiss, A., Boes, R. M., & Pfister, M. (2021). Hydraulic Engineering of Dams (Taylor & F).*

3. *Tanguy, J.-M. (2010). Treatise on Environmental Hydraulics. Water Cycle Engineering Software (Hermes Sci; H. S. Publications, ed.).*

4. *Walski, T. M., & Meadows, M. E. (1999). Computer Applications in Hydraulic Engineering (Haestad Me). Haestad Press.*

Semester 3
Teaching Unit: UEM 2.1
Course Title: Integrated Water Resources Management
Total Hours: 45 hours (Lecture: 1h30/week, Tutorial: 1h30/week)
Credits:4
Coefficient:2

Course Objectives

This course aims to provide students with a comprehensive understanding of the strategies related to sustainable development and the foundational principles of Integrated Water Resources Management (IWRM). Emphasis is placed on managing water resources in response to demand and in accordance with technical, socio-economic, and environmental constraints. Students will also develop the ability to apply decision-making principles and optimization methods to promote sustainable water resource management.

Prerequisite Knowledge

- Prior to enrolling in this course, students should possess:
- Fundamental knowledge of water resources;
- Basic understanding of water abstraction and production infrastructure.

Course Content

- **Chapter I:** Sustainable Development
- **Chapter II:** Strategies for Sustainable Development
- **Chapter III:** Principles of Integrated Water Resources Management
- **Chapter IV:** Implementation of IWRM

Evaluation Method

- Final examinations (60%)
- Continuous assessment (40%)

Suggested Readings and Resources

Books, handouts, academic articles, and selected web-based materials.

Module: Irrigation
Weekly Hours: 2h Lecture / 1h Tutorial or Practical Work
Credits: 3 ECTS
Semester: S3

Module Objectives:

- Understand crop water requirements and fundamental principles of irrigation.
- Learn about various irrigation techniques and systems used in urban and peri-urban environments.
- Apply methods for calculating irrigation doses and scheduling.
- Promote efficient water use in sustainable irrigation projects.

Course Content:

1. Introduction to Irrigation

- Importance of irrigation for food security and urban green space management
- Historical development and evolution of irrigation techniques
- Objectives and performance criteria of irrigation systems

2. Crop Water Requirements

- Evapotranspiration: concepts and calculation (ET_0, ETc)
- Water balance methods
- Factors affecting water needs (soil, climate, crop type)

3. Irrigation Techniques and Systems

- Surface irrigation (gravity-fed)
- Sprinkler irrigation
- Localized irrigation (drip, micro-sprinklers)
- Criteria for selecting appropriate systems for urban contexts

4. Design and Sizing of Irrigation Networks

- Collection of basic data (topography, climate, soil)
- Calculation of flow rates and required pressures
- Equipment selection (pumps, filters, pipelines)
- Automation and control systems

5. Management and Maintenance of Irrigation Systems

- Irrigation scheduling and frequency
- Irrigation efficiency and water losses
- Network maintenance and leak detection
- Sustainable management and water-saving strategies

6. Sustainable Irrigation and the Environment

- Environmental impacts of irrigation
- Use of treated wastewater for irrigation
- Innovative techniques (sensors, precision irrigation)
- Regulatory and economic aspects

Tutorials / Practical Work (TD/TP):

- Calculation of evapotranspiration and crop water requirements
- Simulation of irrigation system design
- Case study: modernization of an irrigated area
- Field visit or real system analysis (when feasible)

Assessment Methods:

- Continuous assessment (tutorials, mini-projects, quizzes): 40%
- Final exam: 60%

Semester: 3
Teaching Unit: UEM 2.1
Subject: Project Management
VHS: 22h30 (Lecture: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

To introduce students to the fundamental and modern principles of project management.

Recommended Prerequisites

No specific prior knowledge is required for this course.

Course Content

Chapter 1: Introduction to Project Management
Chapter 2: History of Project Management
Chapter 3: Modern Project Management – Systemic Approach
Chapter 4: Managerial Functions
Chapter 5: Defining the Project – Work Breakdown Structure (WBS)
Chapter 6: Project Time and Cost Estimation
Chapter 7: Project Planning and Scheduling
Chapter 8: Human Resources
Chapter 9: Motivation
Chapter 10: Decision-Making
Chapter 11: Leadership and Leaders

Evaluation Method

100% Final Exam

References

1. *Jack R. Meredith and Samuel J. Mantel, Project Management: A Managerial Approach, 5th Edition, Wiley, 2006.*
2. *James A. F. Stoner, Management, 3rd Edition, Prentice Hall.*
3. *Chase, Aquilano and Jacobs, Production and Operations Management, 8th Edition, Irwin-McGraw Hill.*
4. *Ray H. Garrison and Eric W. Noreen, Managerial Accounting, 7th Edition, ERWIN.*
5. *Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 2003.*
6. *E. Wendy Trachte-Huber and S. K. Huber, Alternative Dispute Resolution: Strategies for Law and Business, Anderson.*
7. *C. Hendrickson, Project Management for Construction, downloadable from: http://www.ce.cmu.edu/~cth/pmbook/*
8. *Lasary, Le management d'entreprise, self-published, ISBN: 9947-0-1395-2, 2006.*
9. *Clifford F. Gray and Erik W. Larson, Project Management: The Managerial Process, 2nd Edition, McGraw Hill, 2003.*

Module: Hydro-Economics
Weekly hours: 2h Lecture / 1h Tutorial
Credits: 3 ECTS
Semester: S3 (Master 2, First Semester)

Module Objectives:

- Understand economic principles applied to water resource management.
- Apply economic analysis tools in water planning and management.
- Analyze pricing policies and financing mechanisms for water services.
- Assess the economic feasibility of water-related projects (cost-benefit analysis, externalities, sustainability).

Course Content:

1. Introduction to Hydro-Economics
- — Definition and importance
- — Interactions between economics and water management
- — Economic challenges in the water sector

2. Water as an Economic Good
- — Characteristics of water: scarcity, rivalry, exclusion
- — Typology of goods: public, common, private
- — Supply and demand economics in the water sector

3. Water Pricing and Financing
- — Pricing principles: volumetric, flat-rate, increasing block tariffs
- — Pricing by use: domestic, agricultural, industrial
- — Subsidies and cost recovery
- — Financing models for hydraulic infrastructure

4. Economic Evaluation of Water Projects
- — Cost-benefit analysis (CBA)
- — Consideration of externalities
- — Assessment of social and environmental impacts
- — Case studies: dams, potable water networks, wastewater treatment plants

5. Economic Management of Water Demand
- — Economic tools for demand management
- — Financial incentives and user behavior
- — Circular economy and water reuse

6. Water Governance and Policies
- — Institutional and regulatory frameworks
- — Integrated Water Resources Management (IWRM)
- — Political economy of water

Tutorials (TD):

- Local case studies (urban hydraulic projects)
- Pricing simulations
- Analysis of water management policies
- Critical reading of economic reports and articles

Assessment Methods:
- — Continuous assessment (tutorials, presentations, case studies): 40%
- — Final written exam: 60%

Semester: 3
Teaching Unit: UET 2.1
Course: Documentary Research and Thesis Design
Total Hours (VHS): 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

To provide students with the necessary tools to search for relevant information and effectively use 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 Prerequisites

— Writing methodology
— Presentation methodology

Course Content

Part I – Documentary Research

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

— Formulating the topic title
— Listing relevant keywords
— Collecting basic information (specialized vocabulary, definitions)
— Identifying needed information
— Reviewing prior knowledge

Chapter I-2: Selecting Information Sources (2 weeks)

— Types of documents (books, theses, dissertations, journal articles, conference proceedings, audiovisual materials…)
— Types of resources (libraries, internet…)
— Assessing the quality and relevance of sources

Chapter I-3: Locating Documents (1 week)

— Search techniques
— Search operators

Chapter I-4: Processing Information (2 weeks)

— Organizing the research
— Defining initial questions
— Synthesizing selected documents
— Linking content across sections
— Final research outline

Chapter I-5: Bibliography Presentation **(1 week)**

- Bibliographic systems (Harvard, Vancouver, mixed…)
- Formatting sources
- Citing references

Part II – Thesis Design

Chapter II-1: Structure and Stages of the Thesis **(2 weeks)**

- Defining and narrowing the topic (abstract)
- Problem statement and objectives
- Additional sections (acknowledgements, list of abbreviations…)
- Writing the introduction (usually written last)
- Literature review
- Hypotheses formulation
- Methodology
- Results
- Discussion
- Recommendations
- Conclusion and outlook
- Table of contents
- Bibliography
- Appendices

Chapter II-2: Writing Techniques and Standards **(2 weeks)**

- Formatting, numbering of chapters, figures, and tables
- Title page layout
- Typography and punctuation
- Writing style and scientific language (grammar, syntax)
- Spelling and overall linguistic competence
- Saving, securing, and archiving data

Chapter II-3: Workshop – Critical Review of a Manuscript **(1 week)**

Chapter II-4: Oral Presentations and Defenses **(1 week)**

- How to present a poster
- How to deliver an oral presentation
- Thesis defense

Chapter II-5: How to Avoid Plagiarism? **(1 week)**
(Including formulas, phrases, illustrations, graphs, data, statistics…)

- Quoting
- Paraphrasing
- Providing full bibliographic references

Assessment Method

Final exam: 100%

References

1. *M. Griselin et al., Guide de la communication écrite, 2nd ed., Dunod, 1999*
2. *J.L. Lebrun, Practical Guide to Scientific Writing: How to Write for the International Scientific Reader, EDP Sciences, 2007*
3. *A. Mallender Tanner, ABC of Technical Writing: Manuals, User Guides, Online Help, Dunod, 2002*
4. *M. Greuter, Successfully Writing Your Thesis or Internship Report, L'Étudiant, 2007*
5. *M. Boeglin, Read and Write at University: From Idea Chaos to Structured Text, L'Étudiant, 2005*
6. *M. Beaud, The Art of the Thesis, Casbah Editions, 1999*
7. *M. Beaud, The Art of the Thesis, La Découverte, 2003*
8. *M. Kalika, Master's Thesis Writing, Dunod, 2005*