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

HARMONIZED ACADEMIC MASTER

National program

Update 2022

Domain	Channel	Speciality
Science and Technologies	***Civil engineering***	***Structures***

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مواءمة

ماسترأكاديمي

Update 2022

الميدان	الفرع	التخصص
علوم وتكنولوجيا	هندسة مدنية	هياكل

I - Master's identity file

Access conditions

Channel	Harmonized Master	Master's degrees	Courseification license compatibility	Coefficient assigned to the license
Civil engineering	**Structures**	Civil engineering	**1**	**1.00**
		Public works	**2**	**0.80**
		Mechanical engineering	**3**	**0.70**
		Other ST domain licenses	**5**	**0.60**

II - Semester organisation files for speciality courses

Semester 1: Master Structures

Teaching unit	Modules	Credits	Coefficient	Number of hours in the week			Semester Hours (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation	
	Title			**Courses**	**Practical exercises**	**Practical Work**			**Continuous control**	**Exam**
UE Fondamentale Code: UEF 1.1.1 Credits: 8 Coefficients: 4	Structural mechanics	4	2	1h30	1h30		45h00	55h00	40%	60%
	Structural dynamics 1	4	2	1h30	1h30		45h00	55h00	40%	60%
UE Fondamentale Code: UEF 1.1.2 Credits: 10 Coefficients: 5	Reinforced concrete structures 1	4	2	1h30	1h30		45h00	55h00	40%	60%
	Metal structures	6	3	3h00	1h30		67h30	82h30	40%	60%
UE Méthodologique Code: UEM 1.1 Credits: 9 Coefficients: 5	Additional programming	4	2	1h30		1h30	45h00	55h00	40%	60%
	Experimental methods	2	1			1h30	22h30	27h30	100%	
	Innovative materials and durability	3	2	1h30		1h00	37h30	37h30	40%	60%
UE Discovery Code: UED 1.1 Credits: 2 Coefficients: 2	Choice module 1	1	1	1h30			22h30	02h30		100%
	Choice module 2	1	1	1h30			22h30	02h30		100%
UE Transversale Code: UET 1.1 Credits: 1 Coefficients: 1	Technical English and terminology	1	1	1h30			22h30	02h30		100%
Total semester 1		**30**	**17**	**15h00**	**6h00**	**4h00**	**375h00**	**375h00**		

Semester 2 Master Structures

Teaching unit	Modules	Credits	Coefficient	Number of hours in the week			Semester Hours (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation	
	Title			**Courses**	**Practical exercises**	**Practical Work**			**Continuous control**	**Exam**
UE Fondamentale Code: UEF 1.2.1 Credits: 10 Coefficients: 5	Elasticity	6	3	3h00	1h30		67h30	82h30	40%	60%
	Structural dynamics 2	4	2	1h30	1h30		45h00	55h00	40%	60%
UE Fondamentale Code: UEF1.2.2 Credits: 8 Coefficients: 4	Reinforced concrete structures 2	4	2	1h30	1h30		45h00	55h00	40%	60%
	Foundations and Retaining Structures	4	2	1h30	1h30		45h00	55h00	40%	60%
UE Méthodologique Code: UEM 1.2 Credits: 9 Coefficients: 5	Finite element methods	5	3	1h30	1h30	1h00	60h00	65h00	40%	60%
	Steel Structures Project	4	2	1h30		*1h30	45h00	55h00	*70%	30%
UE Discovery Code: UED 1.2 Credits: 2 Coefficients: 2	Choice module 3	1	1	1h30			22h30	02h30		100%
	Choice module 4	1	1	1h30			22h30	02h30		100%
UE Transversale Code: UET 1.2 Credits: 1 Coefficients: 1	Respect of ethical and integrity norms and rules	1	1	1h30			22h30	02h30		100%
Total semester 2		**30**	**17**	**15h00**	**7h30**	**2h30**	**375h00**	**375h00**		

* Practical work sessions in the "**Steel construction project**" subject are face-to-face sessions and take the form of workshops. They are not counted as conventional practical sessions.

Semester 3 Master Structures

Teaching unit	Modules Title	Credits	Coefficient	Number of hours in the week **Courses**	 **Practical exercises**	 **Practical Work**	Semester Hours (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation **Continuous control**	 **Exam**
UE Fondamentale Code: UEF 2.1.1 Credits: 10 Coefficients: 5	Prestressed concrete	6	3	3h00	1h30		67h30	82h30	40%	60%
	Plasticity and damage	4	2	1h30	1h30		45h00	55h00	40%	60%
UE Fondamentale Code: UEF 2.1.2 Credits: 8 Coefficients: 4	Earthquake Engineering	4	2	1h30	1h30		45h00	55h00	40%	60%
	Special works	4	2	1h30	1h30		45h00	55h00	40%	60%
UE Méthodologique Code: UEM 2.1 Credits: 9 Coefficients: 5	Reinforced concrete structures project	6	3	1h30		*3h00	67h30	82h30	*70%	30%
	Structure modeling	3	2			2h30	37h30	37h30	100%	
UE Discovery Code: UED 2.1 Credits: 2 Coefficients: 2	Choice module 5	1	1	1h30			22h30	02h30		100%
	Choice module 6	1	1	1h30			22h30	02h30		100%
UE Transversale Code: UET 2.1 Credits:1 Coefficients: 1	Documentary research and memoir conception	1	1	1h30			22h30	02h30		100%
Total semester 3		**30**	**17**	**13h30**	**6h00**	**5h30**	**375h00**	**375h00**		

*Practical work sessions in the "**Reinforced concrete structures project"** subject are face-to-face sessions and take the form of a workshop. They are not counted as conventional practical sessions.

Open units UED du*(S1, S2, S3)*

Basket =Choose one 3h00 subject (1h30 lectureand 1h30 TD) or 02 subjects of 1h30 each.

1. *Building*
2. *Miscellaneous roads and networks*
3. *Natural and technological hazards*
4. *French Public Procurement Code*
5. *Pathologies and rehabilitation of structures*
6. *Building thermics*
7. *General construction processes*
8. *Project planning and management*
9. ***Other***

Semester 4

In-company internship culminating in a dissertation and oral presentation.

	TOTAL HOURS	Coeff	Credits
Personal work	550	09	18
Internship	100	04	06
Seminars	50	02	03
Other (Management)	50	02	03
Total Semester 4	750	17	30

This table is given for information only

Evaluation of the Master's Final Project

- Scientific value (Jury's assessment) /6
- Dissertation (Jury's assessment) /4
- Presentation and response to questions (Jury's assessment) /4
- Framers assessment /3
- Presentation of internship report (Jury's assessment) /3

III - Detailed syllabus by subject for semester S1

Semester:1
Teaching unit: UEF 1.1.1
Course Title 1: Structural Mechanics
Total hours: 45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

The proposed program reinforces the student's knowledge of structural , acquiring matrix and iterative methods for solving hyperstatic systems.

Recommended Prerequisites:

Notions of applied mathematics, strength of materials.

Contents

Chapter 1: Introduction structural analysis **(2 weeks)**

Chapter 2: Differential relations, calculus of arrows and rotations, internal potential theory, Castigliano Theorem, Menabrea Statement **(3 weeks)**

Chapter 3: Force method **(2 weeks)**
(Notion of internal superabundant bond, methods for simplifying calculations: elastic center method, case where the load is a generalized displacement, case of temperature variations)

Chapter 4: Displacement method **(2 weeks)**

Chapter 5: Iterative methods **(2 weeks)**

Chapter 6: Continuous beams on elastic supports **(2 weeks)**

Chapter 7: Design of arched structures **(2 weeks)**

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1. *Résistance des matériaux appliquée, tome1, M.ALBIGES,CITBTP.*
2. *Resistance of materials, tome1,J. COURBON,Dunod.*
3. *Resistance of materials, V.FEODOSSIEV, MIR-Moscow*
4. *Structures analysis, A.GHALI, NEVILLE, BROWN, Spon -Press.*
5. *Problems of strength of materials, MIROLIOUBOV, MIR-Moscow.*
6. *Structural analysis, ARAM SAMIKIAN,Gaetan Morin.*
7. *Resistance of materials, KERGUIGNAS, Dunod.*
8. *Leçons sur la résistance des matériaux, tome3, E. DREFFUSS.*
9. *Problèmes de résistance des matériaux, tome1 et 2, GIET, Dunod.*
10. *Eléments de la résistance des matériaux, J. COURBON, Dunod.*

Semester:1
Teaching unit: UEF 1.1.1
Course Title 2: Structural Dynamics 1
Total hours: 45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

The aim of this course is to present methods for the calculation and behavior of structures subjected to dynamic loads. The study of vibrations of linear systems, and the response of a structure with one degree of freedom subjected to various types of loading (constant, periodic, impulse), with a view to mastering the design of structures subjected to dynamic loading.

Recommended Prerequisites:

Strength of Materials; Numerical Methods.

Contents:

Chapter 1 Introduction and generalists **(3 weeks)**

- Defining a dynamic problem

(Dynamic loading, Dynamic structure or system, Degrees of freedom of a system, Generalized coordinates

- General dynamic analysis

(Modeling in dynamics, Formulating the equation of motion, Solving the differential equations of motion, Interpreting and exploiting results)

Chapter 2: Systems with a single degree of freedom **(6 weeks)**

- Formulation of the equation of motion
- Free vibration

(Undamped free vibrations, Damped free vibrations, Logarithmic decrement)

- Forced vibration

(Harmonic excitation, Impulsive excitation, Any dynamic excitation)

- Response to support movement

(Substrate harmonic excitation, Substrate seismic excitation)

- Response spectrum

Chapter 3: Systems with several degrees of freedom **(6 weeks)**

- Formulation of equations of motion
- Evaluation of matrices [M], [K], [C] and force vector {P}.

(Stiffness matrix [K], Mass matrix [M], Damping matrix [C], External forces vector {P})

Assessment :

Continuous assessment: 40%; Final exam: 60%.

References :

1 ***J. BETBEDER-MATIBET and J.L. DOURY*** *Constructions parasismiques, Techniques de l'Ingénieur, traité Contruction.*

2 ***Clough P. W. and Penzien J****., Structural Dynamics, Computers and Structures Inc, Berkeley, 2001*

3 ***Chopra, A.K****., Dynamics of Structures - Theory and Application to earthquake engineering, Prentice Hall, New Jersey*

4 ***RPA-99 (2004).*** *Règles Parasismiques Algériennes 1999. Center National de Recherche Appliquée en Génie Parasismique, Algiers.*

5 ***Filialtrault****, Éléments de génie parasismique et de calcul dynamique des structures, Presses internationales Polytechnique 1996.*

6 ***Eurocode 8*** *:Design of structures for earthquake resistance, European Committee for Standardization, NF EN 1998-1 Sept 2005*

7 ***EL. Wilson****, 3-D Static and dynamic analysis, Computers & Structures, 1996.*

Semester:1
Teaching unit: UEF 1.1.2
Course Title: Reinforced Concrete Structures 1
Total hours:45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

The aim of this subject is to teach students how to design and dimension the various reinforced concrete structural elements in a building, while complying with the various building regulations.

Recommended Prerequisites:

Strength of materials, Reinforced concrete

Contents

Chapter 1: Calculation of slab and mushroom floors **(3 weeks)**

- Description and construction of slab floors
- Description and construction of mushroom floors
- Slab calculation

(BAEL lump-sum method, Pigeaud method, Fracture line method)

Chapter 2: Design of reinforced concrete frames under vertical loads **(3 weeks)**

- Introduction
- Distribution of vertical loads on sleepers
- Calculation of gantries using the Caquot method
- Combining stresses and determining maximum beam and span moments

Chapter 3: Portal frame design under horizontal loads **(3 weeks)**

- Introduction
- Notion of center of torsion
- Distribution of horizontal level forces on portal frames using the center of torsion method
- Calculation of portal frames under horizontal forces using Muto's method

Chapter 4: Regulations for columns and beams **(3 weeks)**

- Action combinations (BAEL and RPA 99)
- Regulatory provisions concerning poles
- Regulatory requirements for beams

Chapter 5. Surface foundations **(3 weeks)**

- Footing under wall; Insulated footing under column ;
- Footings under posts; Basements.

Evaluation :

Continuous assessment: 40%; Final Exam: 60%.

References:

1. *Reinforced and Prestressed concrete'; by FK KONG and RH EVANS; 3rd edition, Van Nostrand Reinhold international, London.*
2. *Reinforced Concrete Design'; by WH MOSELY and JH BUNGEY; Fourth edition, MacMillan*
3. *Traité de Béton Armé'; by R LACROIX, A.FUENTES and H THONIER; Editions Eyrolles, Paris.*
4. *Pratique du BAEL' ; J.PERCHAT et J.ROUX ; Editions Eyrolles,Paris.*

Semester:1
Teaching unit: UEF 1.1.2
Course Title 2: Metal Structures
Total hours: 67h30 (Course 3h00, Practical exercises: 1h30)
Credits: 6
Coefficient: 3

Course Objectives:

On completion of this course, the knowledge acquired should enable the student correctly dimension the structural elements of a steel structure.

Recommended Prerequisites:

To be able to follow this course, you'll need to know about: the materials used in CM; the basis for calculating framing in CM; strength Courses for cross-sections; design strengths for cross-sections and elements; connections.

Contents

Chapter 1: Design and calculation of beam - column connections **(3 weeks)**
(Beam - column welded connection, Beam - column bolted end plate connection)

Chapter 2: Design and calculation of column feet **(3 weeks)**
(Hinged post feet, Recessed post feet)

Chapter 3: Design and calculation of crane runways: **(2 weeks)**
(Courseification of overhead cranes, Actions on the running girder, Running design, Braking beams, Shear beam resistance, Resistance of webs to transverse loads)

Chapter 4: Composite floors **(3 weeks)**
(Design and calculation of composite beams, Connection calculation)

Chapter 5: Structural steelwork **(2 weeks)**
(Steel frame industrial buildings, Steel frame multi-storey buildings)

Chapter 6: Analysis methods for structural steelwork **(2 weeks)**
(Courseification of structures, Choice of analysis method, Consideration of imperfections in load calculations)

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References:

1. *J. MOREL: Calcul des Structures Métalliques selon l'EUROCODE 3.*
2. *P. BOURRIER; J. BROZZETTI: Construction Métallique et Mixte Acier-Béton - Tomes 1 et 2 - EYROLLES.*
3. *Document Technique Réglementaire - DTR - BC 2.44 - Design and Calculation Rules for Steel Structures "CCM97".*
4. *Document Technique Réglementaire - DTR - BC 2-4.10 - Design and Sizing of Mixed Steel-Concrete Structures.*
5. *EUROCODE N°3 - Structural steel design - Part 1-8: Design of connections*

Semester:1

Teaching unit: UEM1.1
Course Title 1: Complementary programming
Total hours: 45h00 (Course: 1h30, Practical Work: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

This course is designed to deepen students' knowledge of programming. It introduces the concepts of modular programming.

Recommended Prerequisites:

General computing, programming language

Contents

Chapter 1: Programming techniques and program structuring	**(3 weeks)**
Chapter 2. Using procedures and functions	**(4 weeks)**
Chapter 3. Modular programming	**(4 weeks)**
Chapter 4: Application examples	**(4 weeks)**

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References:

1. *Concepts in programming languages. J.C. MITCHEL. Mitchel, Prentice Hall 1997*
2. *M. BOUMAHRAT, A. GOURDIN "Méthodes numériques appliquées" OPU 1993*
3. *VARGA "Matrix iterative analysis" Printice Hall, 1962*
4. *BESTOUGEFF "La technique informatique: Algorithmes numériques et non numériques" Volume 2, Masson, 1975*

Semester:1
Teaching unit: UEM1.1
Course Title 2: Experimental methods
Total hours: 22h30 (Practical Work: 1h30)
Credits: 2
Coefficient: 1

Course Objectives:

This course provides students with key experimental tools for the rheological and mechanical characterization of selected materials, as well as for evaluating their long-term durability.

Recommended Prerequisites:

Construction materials taught at the undergraduate level

Contents

Chapter 1: Testing fresh self-Compacting concrete **(5 weeks)**

- Slump-flow test by Abrams cone
- L-box test
- Sieve stability test

Chapter 2: Durability Testing of Concrete **(5 weeks)**

- Chemical attacks
- Carbonation-induced corrosion

Chapter 3: Mechanical Testing of Mortars and Concretes & Valorization of Materials **(5 weeks)**

- Mortars and concretes using Portland cement and substitute cementitious materials

Evaluation :

Continuous assessment: 100% ;

References:

1. *Association Française de Génie Civil (AFGC), Recommandations pour l'emploi des bétons auto-plaçants, Documents scientifiques et techniques, (2008).*
2. *Association Française de Génie Civil (AFGC), Conception des bétons pour une durée de vie donnée des ouvrages Documents scientifiques et techniques, (2004)*

Semester:1
Teaching unit: UEM1.1
Course Title 3: Innovative materials
Total hours: 37h30 (Course: 1h30, Practical work:1h00)
Credits: 3
Coefficient: 2

Course Objectives:

Provide the specific knowledge needed to undertake high-level research on new materials. Train students to become managers and/or experts in materials research and development.

Recommended Prerequisites:

Building materials taught in the Bachelor's program

Contents

Chapter 1: Eco-Materials **(3 weeks)**

- Materials recovery :
- Natural materials (stone, clays for stabilized mud bricks, natural pozzolans)
- Activated materials (calcined clays: metakaolin, rice husk ash)
- Industrial by-products and waste (rubber aggregates, slag and LD, sediments, biomass ash: WWTP, animal meal, recycled glass)

Chapter 2. Alternative binders and substitutes **(4 weeks)**

- Organic binders: clay
- Helitic binders
- Glass binders
- Geopolymers, inorganic polymers
- Natural and artificial pozzolans

Chapter 3: New materials **(4 weeks)**

Self-compacting concrete (formulation and fresh state, hardened state and durability) Hemp concrete
Fiber concrete

Chapter 4: Building materials **(4 weeks)**

- Improving BHP, BTHP and BUHP prefabrication processes
- Low-pH concretes
- Injection grout

Evaluation :

Continuous assessment: 40%; Final exam: 100 %.

References:

1. *Association Française de Génie Civil (AFGC), Recommandations pour l'emploi des bétons auto-plaçants, Documents scientifiques et techniques, (2008)*
2. *G. DREUX, Jean FESTA "Nouveau guide du béton et de ses constituants" Eyrolles, 1998*

Semester: 1

Teaching unit: UET1.1
Course Title 1: Technical English and terminology
Total hours: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Course Objectives:

Introduce students to technical vocabulary. Reinforce their knowledge of the language. Help them understand and synthesize a technical document. Enable them to understand an English conversation a scientific context.

Recommended Prerequisites:

Basic English vocabulary and grammar

Contents

- Reading comprehension: Reading and analysis of texts related to the specialty.

- Listening comprehension: From authentic video documents popularizing science, take notes, summarize and present the document.

- Oral expression: Presentation of a scientific or technical subject, preparation and exchange of oral messages (ideas and data), telephone communication, body language.

- Written expression: Extracting ideas from a scientific document, writing a scientific message, exchanging information in writing, writing CVs, letters of application for internships or jobs.

Recommendation: It is strongly recommended that at the end of each session (at most), the person responsible for the subject should present and explain a dozen or so technical words from the specialty in the three languages (if possible) English, French and Arabic.

Evaluation :

Final exam: 100%.

References :

1. *P.T. Danison, Guide pratique pour rédiger en anglais: usages et règles, conseils pratiques, Editions d'Organisation 2007*
2. *A.Chamberlain, R. Steele, Guide pratique de la communication: anglais, Didier 1992*
3. *R. Ernst, Dictionnaire des techniques et sciences appliquées: français-anglais, Dunod 2002.*
4. *J. Comfort, S. Hick, and A. Savage, Basic Technical English, Oxford University Press, 1980*
5. *E. H. Glendinning and N. Glendinning, Oxford English for Electrical and Mechanical Engineering, Oxford University Press 1995*
6. *T. N. Huckin, and A. L. Olsen, Technical writing and professional communication for nonnative speakers of English, McGraw-Hill 1991*
7. *J. Orasanu, Reading Comprehension from Research to Practice, Erlbaum Associates 1986*

IV - Detailed S2 semester syllabus by subject

Semester:2
Teaching unit: UEF 1.2.1
Course Title 1: Elasticity
Total hours: 67h30 (Course: 3h00, Practical exercises: 1h30)
Credits: 6
Coefficient: 3

Course Objectives:

To provide students with calculation methods enabling them to analyze the mechanical functioning of structures, to design them soundly, and to acquire the basic needed to use software.

Recommended Prerequisites:

Basic knowledge of mathematics and strength of materials.

Contents

Chapter 1: Introduction to the theory of elasticity **(1 week)**
(General information elasticity, Mathematical background, Index notation)

Chapter 2: Theory of the state of stress **(3 weeks)**
(Stress tensor, Differential equations of equilibrium, Stress on a plane, Stress and principal directions, Geometric representation (Mohr's tri-circle))

Chapter 3: Deformation state theory **(1 week)**
(General, Strain tensor, Relationship between strains and displacements, strains and principal directions, Geometric representation (Mohr's tri-circle), Strain compatibility equation, Strain measurement)

Chapter 4: Stress-strain relationships and behavior laws **(2 weeks)**
(Generalized Hooke's law, Influence of temperature, Deformation energy)

Chapter 5: General equations of linear elasticity **(2 weeks)**
(Lamé equations, Beltrami-Michell equations, Saint Venant principle ....)

Chapter 6: Solving plane elasticity problems **(2 weeks)**
(AIRY function, plane deformation problem, plane stress problem)

Chapter 7: Beam bending **(2 weeks)**

Chapter 8: Study of thin plates **(2 weeks)**

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References:

1. *Theory of Elasticity / Timoshenko and Goodier*
2. *Exercices d'élasticité / Caignaerd and J.P. Henry Editions: Dunod*
3. *Structural mechanics (volume 2) / François Frey Publisher: EPFL Press*
4. *Plate and shell theory, Timoshenko Woinowsky-Krieger*
5. *Mathematical elasticity A. E. Love*
6. *Continuum mechanics Volume 3 Plates and shells*
7. *Theory of elasticity E. Green and W. Zerna.*
8. *Structural design. COURBON (J.). Dunod (1972).*

Semester: 2
Teaching Unit: UEF 1.2.1
Course Title 2: Structural Dynamics II
Total hours: 45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives :

The aim of this course is teach the behavior of engineering structures, making use of several methods used in the dynamic analysis of engineering structures.

Recommended prior knowledge:

RDM; Structural Dynamics I; Programming language; Numerical methods.

Contents

Chapter 1: S.P.D.D.L. free vibration **(3 weeks)**

- Introduction
- Undamped free vibration SPDDL (modal analysis)
- Orthogonality of eigenmodes
- Applications

Chapter 2: Forced vibration of S.P.D.D. L **(6 weeks)**

- Modal superposition method

(Decoupling differential equations, Solving decoupled differential equations, Superposition of modal responses, Applications)

- Spectral modal method

(Response and design spectra, Calculation of modal seismic forces, Combination of modal responses, Applications)

Chapter 3: Pushover method **(6 weeks)**

- Principle
- Structure definition and behavior laws for elastic nodes
- Definition of lateral force distribution
- Determining seismic demand
- Static non-linear analysis of the structure
- Transformation into a system equivalent to a single DDL
- A-D structure capacity curve and SSDL target displacement
- Determination of target displacement for multi-degree-of-freedom system and evaluation of global and local demand
- Performance evaluation and damage analysis
- Application

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References :

1. ***J. BETBEDER-MATIBET and J.L. DOURY*** *Constructions parasismiques, Techniques de l'Ingénieur, traité Contruction.*
2. ***Clough P. W. and Penzien J****., Structural Dynamics, Computers and Structures Inc, Berkeley, 2001*
3. ***Chopra, A.K****., Dynamics of Structures - Theory and Application to earthquake engineering, Prentice Hall, New Jersey*
4. ***RPA-99 (2004).*** *Règles Parasismiques Algériennes 1999. Center National de Recherche Appliquée en Génie Parasismique, Algiers.*
5. ***Filialtrault****, Éléments de génie parasismique et de calcul dynamique des structures, Presses internationales Polytechnique 1996.*
6. ***Eurocode 8*** *:Design of structures for earthquake resistance, European Committee for Standardization, NF EN 1998-1 Sept 2005*
7. ***EL. Wilson****, 3-D Static and dynamic analysis, Computers & Structures, 1996.*

Semester: 2
Teaching unit : UEF 1.2.2
Course Title 1 : Reinforced Concrete Structures 2
Total hours: 45h (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives :

The reinforced concrete structure (2) program complements the same subject in S1. The student must be able to select and use the appropriate calculation methods for the design, dimensioning and reinforcement of the elements making up the structure.

Recommended prior knowledge:

RDM; Calculation of straight sections in BA

Contents :

Chapter 1: Calculating secondary elements **(3 weeks)**

(Stairs, balconies, Acroteria)

Chapter 2: Bracing systems **(5 weeks)**

Choice and general bracing of buildings using: porticos, rigid walls, triangulated walls, concrete walls, stability cores and mixed solutions. Location and torsion of sails in structures. Principles of earthquake-resistant building design

Chapter 3: Sails **(3 weeks)**

Types, characteristics and strength of walls
Reinforcement of overmantels and lintels

Chapter 4: Deep foundations **(4 weeks)**

Footing on a pile, and several piles; General rafts

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References:

1. *Guerrin and R. C. Lavaur, "Traité de béton armé ; Ossatures d'immeubles et d'usines, planchers, escaliers, encorbellements, ouvrages divers du bâtiment, Tome 4", Dunod, 1971.*
2. *Jean Pierre Mougin, "Béton armé, BAEL 91 modifié 99 et DTU associés", Eyrolles, 2000.*
3. *Règles BAEL 91, "Règles techniques de conception et de calcul des ouvrages et constructions en béton armé suivant la méthode des états limites", Eyrolles, March 1992.*
4. *Georges Dreux, "Calcul pratique du béton armé. Règles BAEL 83", 1983*
5. *Christian Albouy, "Eurocode 2: béton armé - éléments simples", CERPET - STI, 2007.*
6. *J. A. Calgaro, "Applications de l'Eurocode 2 - Calcul des bâtiments en béton", ponts et chaussée, 2007.*
7. *A.CHANTI, Building wall bracing. O.P.U.*
8. *ALBIGÈS (M.) and GOULET (J.). - Building bracing. Ann. ITBTP, May 1960.*
9. *GRINDA (L.). - Calculation of bracing walls for multi-storey buildings. Ann. ITBTP, 1967.*
10. *Coin A., Decauchy A. and Collignon J.P., Murs de contreventement à ouvertures multiples. An. ITBTP, 71.*
11. *Henry Thonier, Conception et calcul des structures en béton armé. Presse de l'école nationale des Ponts et Chaussées, volumes 2, 3 and 4. Published by Eyrolles.*

Semester: 2
Teaching unit: UEF 1.2.2
Course Title 2: Foundations and Retaining Structures
Total hours: 45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

This course aims to provide students with knowledge of the various types of foundations and how to determine their bearing capacity. It will also help students become familiar with the design and analysis of certain types of retaining structures, as well as the stabilization and reinforcement of sloped soils.

Recommended Prerequisites:

- Soil mechanics courses from semesters 4, 5, and 6 of the Civil Engineering Bachelor's program
- Strength of Materials

Contents

Chapter 1: Review of Shear Strength of Soils **(2 weeks)**

- Introduction to the mechanical behavior of soils (examples of shear failure, Coulomb failure criterion, stress-strain behavior under different consolidation and drainage conditions)
- Limit equilibrium states according to Rankine, Boussinesq, and Prandtl theories

Chapter 2: Design of Shallow Foundations **(4 weeks)**

- Failure modes, bearing capacity theory, and bearing capacity calculation for different types of shallow foundations and loading conditions
- Calculation of allowable stress and settlement estimation

Chapter 3: Design of Deep Foundations **(4 weeks)**

- Types of deep foundations, execution methods, and calculation methods for the bearing capacity of single piles and pile groups (static method, driving formula, cone penetration test (CPT), pressuremeter test)
- Positive and negative skin friction, calculation of allowable stress, deep foundation project

Chapter 4: Retaining Structures and Soil Reinforcement **(5 weeks)**

- Courseification of retaining structures (Gravity walls, Reinforced concrete walls, Sheet pile walls, Diaphragm walls, Mechanically stabilized earth walls)
- Load and stress calculations, design and verification of retaining structures
- Introduction to slope reinforcement techniques

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References :

1. G. Philipponnat and B. Hubert, Fondations et ouvrages en terre, Ed. Eyrolles, 1997
2. G. Frank, Calcul des fondations superficielles et profondes, Presses des ponts, 1999
3. J. Costet and G. Sanglerat, Cours pratique de mécanique des sols (Tome2) Ed. Dunod 1983
4. G. Sanglerat, G. Olivari and B. Cambou, Problèmes pratiques de mécanique des sols et de fondations (Tome2) Ed. Dunod1983
5. F. Schlosser and P. Unterreiner, Renforcement des sols par inclusions, Ed. techniques de l'ingénieur, C245.

Semester: 2
Teaching Unit: UEM 1.2
Course Title 1: Finite element methods
Total hours: 45h00 (Course: 1h30; Practical Work: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

The aim of this course is teaching the finite element method as a way of solving problems in Mechanics (Civil Engineering in particular) governed by partial differential equations with boundary conditions. The aim is to help students understand how the method works, so that they can master its use in numerical modeling software.

Recommended Prerequisites:

Numerical Methods; Strength of Materials; Elasticity.

Contents:

Chapter 1: Introduction and Objectives **(2 weeks)**

Reminder of the equations of equilibrium of an elastic solid
Exact solution and Approximate solution

Chapter 2: One-Dimensional Finite Elements **(5 weeks)**

- Spring element (Stiffness matrix by direct method, Assembly, boundary conditions, resolution)
- Bar element and lattice system (Variational formulation (strong and weak), Element type (Interpolation function), Stiffness matrix using the virtual work principle, Assembly, Transformation matrix, Boundary conditions, Resolution)
- Finite Element Beam and Portal (Variational formulation (strong and weak), Element (Interpolation function), Stiffness matrix by potential energy minimization, Assembly, Transformation matrix, Boundary conditions, Resolution)

Chapter 3: Finite Elements in Two and Three Dimensions **(6 weeks)**

- Interpolation and interpolation functions (3-node triangular element; 6-node triangular element; 4-node quadrangular element; 4-node tetrahedral solid element; rectangular solid element).
- Stiffness matrix construction (6-node triangular element; 4-node quadrangular element; 4-node tetrahedral solid element)
- Finite element bending of plates

Chapter 4: Finite Elements in Dynamics **(2 weeks)**

- Construction of the finished element in One Dimension
- Generalization to two- and three-dimensional problems.

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References :

1. *Gouri Dhatt, Gilbert Touzot, Emmanuel Lefrançois "Finite element method" hermes science publications-2004.*
2. Olek C Zienkiewicz, Robert L Taylor, J.Z. Zhu, The finite element method: its basis and fundamentals.ISBN: 978-1-85617-633-0-Butterworth-Heinemann*; 7 edition, 2013*
3. Jacob Fish, Ted *BelytschkoA First Course In Finite Elements, Wiley, 2007*
4. *Christian Wielgozes Courses and exercises in strength of materials, elasticity-plasticity, finite elements. ISBN-10: 2729879315 Ellipses, 2000.*

Semester: 2

Teaching Unit: UEM 1.2
Course Title: Steel Structures Project
Total hours: 60h00 (Course: 1h30; Practical Work: 2h30)
Credits: 5
Coefficient: 3

Course Objectives:

The objective of this course is to guide students in designing and calculating a structure made of steel framing. The project takes place in the form of a workshop, where the instructor will guide students to apply various theoretical concepts related to steel structures to design and calculate a complete project. The practical sessions will be face-to-face supervision sessions conducted as workshops. They will not be counted as conventional lab practical.

Recommended Prerequisites:

Steel construction, Steel structures.

Contents

Chapter 1: Gathering and formulating preparatory elements: **(2 weeks)**
(Project data, study objectives, regulatory requirements, technical data sheets of construction products)
Chapter 2: Design of a main frame for an industrial hall building **(2 weeks)**
Chapter 3: Design of structural elements for the roof and façades **(2 weeks)**
Chapter 4: Assessment of snow and wind loads on buildings **(2 weeks)**
Chapter 5: Sizing of load-bearing metallic elements for the roof and façades **(1 week)**
Chapter 6: Static analysis of transverse frames and sizing of main elements **(2 weeks)**
Chapter 7: Study of bracing systems using trusses **(1 week)**
Chapter 8: Design and sizing of some joints/connections **(2 weeks)**
Chapter 9: Preparation of graphical documentation for execution works **(1 week)**

Evaluation :

Continuous assessment: 70%; Final exam: 30%.

References :

1. *DTR BC 2.44, Règles CCM97 de conception et du calcul des structures en acier, published by the CGS national center, Algiers, 1998,*
2. *D.T.R 2-4.7, Règles définissant les effets de la neige et du vent sur les constructions "R.N.V.1999", published by the CNERIB national center, Algiers, 2000*
3. *Dahmani L., Calcul des éléments résistants d'une structure métallique, OPU edition, Algiers, 2009,*
4. *Hirt M., Crisinel M., Charpentes Métalliques, Volume 11 of the TGC treatise, Presses universitaires PPUR, Lausanne, Switzerland, 2005*
5. *Morel J., Calcul des Structures Métalliques selon l'Eurocode 3, Eyrolles, Paris, 2005*
6. *Landowski M., Lemoine B., Concevoir et construire en acier, published by Arcelor, Luxembourg 2005.*

Semester: 2

Teaching Unit: UET 1.2
Course Title: Respect of ethical and integrity norms and rules
Total Hours: 22h30 (Course : 1h30)
Credit: 1
Coefficient: 1

Course Objectives:

Develop students' awareness of the ethical principles and rules governing life at university and in the world of work. Make them aware of the need to respect and value intellectual property. Explain the risks of moral evils such as corruption and how to combat them, and alert them to the ethical issues raised by new technologies and sustainable development.

Recommended prior knowledge:

Ethics and deontology (the basics)

Contents :

A.Respect ethics and integrity,

1. **Reminder of the MESRS Charter of Ethics and Professional Conduct:** Integrity and honesty. Academic freedom. Mutual respect. Scientific truth, objectivity and critical thinking. Fairness. Rights and obligations of students, teachers, administrative and technical staff,

2. Research with integrity and responsibility

- Ethical principles teaching and research
- Teamwork responsibilities: Professional equal treatment. Anti-discrimination conduct. Looking after the general interest. Inappropriate behavior in the context of teamwork
- Adopting responsible conduct and combating abuses: Adopting responsible conduct in research. Scientific fraud. Conduct to combat fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to avoid unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.

3. Ethics and deontology in the world of work :

Legal confidentiality in the workplace. Corporate . Corporate responsibility, conflicts of interest. Integrity (corruption in the workplace, its forms and consequences, methods of combating and punishing 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 digital environment

Introduction. copyright, software copyright, the specific case of free software.

2. Internet and e-commerce copyright

Domain name law. Intellectual property on the Internet. E-commerce site law. Intellectual property and social networks.

3. Patent

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

III- Protecting and promoting intellectual property

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

C. Ethics, sustainable development and new technologies

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

Assessment :

Final exam: 100%.

References:

1. Charter academic ethics and deontology, https://www.mesrs.dz/documents/12221/26200/Charte+fran ais+d f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Decree No. 933 of July 28, 2016 establishing rules for preventing and combating plagiarism
3. primer, United Nations Educational, Scientific and Cultural Organization (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. and 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, 2nd quarter 2002, n°94.
11. Jacquet-Francillon, François. Notion : déontologie professionnelle. Le télémaque, May 2000, no. 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. The engineer at the heart of innovation. Belfort-Montbéliard University of Technology
17. Fanny Rinck etléda Mansour, Literacy in the digital age: copying and pasting among students, Université grenoble 3 and Université paris-Ouest Nanterre la défense Nanterre, France
18. Didier DUGUEST IEMN, Citer ses sources, IAE Nantes 2008
19. Similarity detection software: a solution to electronic plagiarism? Report of the Groupe de travail sur le plagiat électronique presented to the CREPUQ Subcommittee on Pedagogy and ICT

20. Emanuela Chiriac, Monique Filiatrault and André Régimbald, Guide de l'étudiant: l'intégrité intellectuelle plagiat, tricherie et fraude... les éviter et, surtout, comment bien citer ses sources, 2014.
21. Université de publication, Stratégies de prévention du plagiat, Intégrité, fraude et plagiat, 2010.
22. Pierrick Malissard, Intellectual property: origin and evolution, 2010.
23. World Intellectual Property Organization website www.wipo.int
24. http://www.app.asso.fr/

V - Detailed syllabus by subject for semester S3

Semester:3
Teaching unit: UEF 2.1.1
Course Title 1: Prestressed concrete
Total Hours: 67h30 (Cours: 3h, Practical exercises: 1h30)
Credits: 6
Coefficient: 3

Course Objectives:

The aim of this subject is to give students the knowledge necessary for the study of pre-stressed concrete beams by pre-tension and post tension.

Recommended Prerequisites:

Mathematics**,** RDM, MDC and reinforced concrete.

Contents

Chapter 1**: General information on prestressed concrete (1 week)**
History, Introduction, Principle of prestressing, Advantages and disadvantages of prestressing.

Chapter 2: **Pre-stressed concrete materials and equipment (1 week)**
Cement, Concrete, Prestressing reinforcement, Passive reinforcement.

Chapter 3: **Prestressing Modes (2 weeks)**
Prestressing by pre-tensioning, Prestressing by post-tensioning, Other techniques.

Chapter 4: **Prestress losses (3 weeks)**
Instantaneous and delayed prestress losses in post-tensioning, Tension losses in pre-tensioning, Instantaneous and delayed losses, Characteristic values of prestressing reinforcement tensions.

Chapter 5: **Bending of isostatic beams (3weeks)**
General, Resistant sections, Actions and loads, Verification classes, Bending calculation at the ELS, Important concepts, Calculation of sections in classes I and II, Calculation of sections in classes III, Bending calculation at the ELU, Section balance at the ELU, Characterization of an ultimate limit state, Principle of justifications, Equation of the problem, Other ultimate limit states.

Chapter 6: **Continuous beams on simple supports**: **(2 weeks)**
Calculation of hyperstatic prestressing loads by the internal method, Calculation of prestressing loads by the direct method

Chapter 7**: Resistance to Tangent Stresses (2 weeks)**
Shear stress resistance, Effects of shear stress, Reduction of shear stress, Calculation of shear stress, Verification of shear stress at ELS and ELU, Torsional strength, Important concepts, Behavior of a beam in B.A or B.P Vis Torsion, Torsion Verification at ELS and ELU..

Chapter 8**: Justification of special sections (1 week)**
Introduction, Support zone, Post-tensioning introduction , Pre-tensioning introduction zone.

Assessment :
Continuous assessment: 40%; Final exam: 60%.

References:

1. Practical course in prestressed concrete by G.DREUX.
2. Prestressed concrete construction by Y.GUYON.
3. Le béton précontraint aux état limite by H.THONIER.
4. Prestressed concrete course by J.FAUCHET.
5. Prestressing by Albert CHAUSSIN and R. LA CROIX.

Semester: 3
Teaching Unit: UEF 2.1.1
Course Title 2: Plasticity and damage
Total Hours: 45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

The main objective of this course is to enable students to understand the tools for calcu-lating civil engineering structures, beyond their elastic limit, up to failure. The course deals with the consideration of the anelastic behavior (plastic and/or damage) of materials in the evaluation of the behavior of structures at failure. A link with regulations is also established.

Recommended Prerequisites:

Elasticity; Continuum Mechanics; Strength of Materials.

Contents

Chapter 1: Introduction to anelastic structural design **(1 week)**

(Notion of behavior laws, Necessity of plastic calculation)

Chapter 2: Plastic calculation of structures **(6 weeks)**

Plastic traction

Plastic bending

- Concepts of plastic hinge and moment-curvature
- Study of homogeneous sections with axes of symmetry
- reinforced concrete sections

Determination of capacity curves (Force-Displacement) of structures (lattices, beams, frames) by incremental analysis

Chapter 3. Limit analysis applied to the calculation of structures **(5 weeks)**

Principle of limit analysis

The theorems of limit analysis

- Static theorem
- Kinematic theorem

Application to calculations of the collapse load of structures

Limit analysis and regulations (ELU, seismic design)

Chapter 4: Damage **(3 weeks)**

- Introduction to damage mechanics
- Damage to concrete and reinforced concrete structures
- Some damage patterns
- Structural damage (Concept of damage index, local-global damage relationship)

Evaluation mode:

Continuous assessment: 40%; Final exam: 60%.

References :

- Milan Jirasek & Zdenek P. Bazant "Inelastic Analysis of Structures" Wiley. 2002.
- Patrick de Buhan "Élasticité et calcul à la rupture" Presses des ponts. 2007
- Jean Lemaître & Jean-Louis Chaboche "Mechanics of solid materials", 3rd edition Dunod. 2009.

Semester:3
Teaching unit: UEF 2.1.2
Course Title 1: Earthquake engineering
Total Hours: 45h (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

To provide students with fundamental knowledge in Earthquake Engineering so that future engineers are capable of critical analysis of the current seismic design codes (RPA 99 – 2003 version and Eurocode 8-1).

Recommended prior knowledge

- Structural dynamics 1 and 2, Reinforced concrete structures 1 and 2, Steel structures.

Contents

Chapter 3: Characteristics of Earthquake-Resistant Buildings *(2 weeks)*

- Basic design principles:
  - Structural simplicity
  - Uniformity, symmetry, and redundancy
  - Strength and stiffness in both directions (torsional effects)
  - Diaphragm action at floor levels
  - Proper foundations
- Structural regularity criteria:
  - Plan regularity
  - Elevation regularity

Chapter 1: Basics of Seismology **(2 weeks)**

- Causes of earthquakes
- Seismic waves
- Earthquake measurement systems
- Seismic hazard, study of a practical case

Chapter 2: Objectives of Seismic Protection and Design Methods **(1 week)**

- Performance objectives
- Design methods
- Verification principles
- Design principles

Chapter 3: Characteristics of Earthquake-Resistant Buildings **(2 Weeks)**

- Basic design principles:
  - Structural simplicity
  - Uniformity, symmetry, and redundancy
  - Strength and stiffness in both directions (torsional effects)
  - Diaphragm action at floor levels
  - Proper foundations
- Structural regularity criteria:
  - Plan regularity
  - Elevation regularity

Chapter 4: Classification Criteria **(1 Week)**

- Seismic zones – zone acceleration coefficient
- Classification of structures by importance
- Locations - average dynamic amplification factor
- Bracing systems – overall behavior factor of the structure

Chapter 5: Seismic Force Calculation – Equivalent Static Method **(3 weeks)**

- Conditions of use – Principle – modeling
- Calculation of total seismic force
- Vertical distribution of seismic forces (story levels)
- Accidental torsion effects
- Horizontal distribution of seismic forces to bracing elements
- Safety verification

Chapter 6: Modal Response Spectrum Metho **(3 weeks)**

- Principle, modeling, response spectrum, seismic force calculation
- Common provisions for both methods:
  - Overturning stability
  - Displacement calculation
  - Safety verification

Chapter 7. Ductility Concept and Detailing Requirements **(2 weeks)**

- Concept of ductility and introduction to capacity design
- Construction detailing:
  - Specific requirements for structural elements
  - Additional provisions for non-structural elements

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References:

1- RPA-99, 2003. *Règles parasismiques Algériennes 1999*. Document technique réglementaire DTR-BC 248 - Centre National de Recherche Appliquée en Génie sismique (CGS), Algiers, 90p.
2- Eurocode 8-1, Design of structures for their resistance to earthquakes - Part 1: General rules, seismic actions and rules for buildings, 2005.
3- DAVIDOVICI (V.). - *Earthquake-resistant design begins with the choice of building form.* Les cahiers techniques du bâtiment, no 97, March 1988.
4- Fuentes, A., 1988. *Post-elastic behavior of reinforced concrete structures.* Paris, Eyrolles, 124p.
5- André PLUMIER, constructions en zone sismique, Edition 2006, université de liège, Document downloadable from the ArGEnCo Department website: ww.ArGEnCo.ULg.ac.be.

Semester:3
Teaching unit: UEF 2.1.2
Course Title 2: Special works
Total Hours: 45h00 (Course: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:

This course covers the design, dimensioning and reinforcement of certain works other than those of the building according to EuroCode EC2.

Recommended Prerequisites:

Strength materials, Reinforced concrete.

Contents

Chapter 1: Retaining walls	**(3 weeks)**
Chapter 2: Domes	**(2 weeks)**
Chapter 3: Silos	**(3 weeks)**
Chapter 4: Reservoirs and Water Towers	**(3 weeks)**
Chapter 5: Reinforced concrete bridges	**(2 weeks)**

Evaluation :

Continuous assessment: 40%; Final exam: 60%.

References:

1. *Le béton armé selon les eurocodes 2 (Dunod 2010)*
2. *Calcul des structures en béton armé (Eyrolles 2013)*
3. *Dimensioning concrete structures to Eurocode 2(Le monitreur 2010)*
4. *Structures en béton armé (Eyrolles 2011).*

Semester:3
Teaching unit: UEM 2.1
Course Title 2: Structural modeling
Total Hours: 37h30 (Practical work:2h30)
Credits: 3
Coefficient: 2

Course Objectives:

This course introduces the fundamental principles of modeling various types of structures using the finite element method with software such as SAP2000, Robot Structural Analysis, ETABS, etc.).

Recommended Prerequisites:

• Basic principles of the finite element method
• Basic knowledge of reinforced concrete
• Basic understanding of seismic and wind design

Contents

Chapter 1: Introduction to Civil Engineering Software

Chapter 2: Steps in Modeling a Structure Using Software

Chapter 3: Modeling a Reinforced Concrete Structure (Residential or Administrative Building)

Chapter 4: Modeling a Steel Frame Structure (Industrial Warehouse)

Evaluation :

Continuous assessment: 100%.

References:

- Document technique réglementaire (D.T.R. BC 2.2). Permanent loads and operating loads.
- Algerian seismic rules RPA 99 version 2003. DTR -BC-2.48.
- Snow and wind regulations RNV 1999. DTR-C-2-4.7.
- Software user manual.

Semester:3
Teaching unit: UEM 2.1
Course Title 1: Reinforced Concrete Structures Project
Total Hours: 67h30 (Course: 1h30, Practical work : 3h00)
Credits: 6
Coefficient: 3

Course Objectives:

The aim of this course is to give students the opportunity to develop and perform calculations for a project in a design office setting. The professor will supervise and guide he students during in-person sessions. Practical works sessions will be conducted in a workshop format and will not be considered as conventional laboratory sessions.

Recommended Prerequisites:

This course requires a good knowledge of Strength of Materials – Structural Mechanics – Plastic Analysis of Structures – Finite Element Method (FEM) – Reinforced Concrete – Elasticity – Structural Modeling.

Contents

Project introduction and description
Presentation of the different steps of project calculation
Design assumptions
Materials used
Codes and standards used
Selection of the structural system (composite structures: shear walls + frames)
Dimensioning of structural elements (columns, beams, shear walls) and load assessment
Dimensioning and reinforcement detailing of slabs
Design of secondary elements (e.g., balcony, parapet) and reinforcement detailing
Dimensioning and reinforcement detailing of Stairs
Seismic analysis
Design and reinforcement detailing of reinforced concrete structural elements
Dimensioning and reinforcement detailing of foundation
Conclusions and perspectives

Evaluation :

Continuous assessment: 70%; Final exam: 30%.

References:

Reinforced and Prestressed concrete'; by FK KONG and RH EVANS; 3rd edition, Van Nostrand Reinhold international, London.
Reinforced Concrete Design'; by WH MOSELY and JH BUNGEY; Fourth edition, MacMillan
'Traité de Béton Armé'; by R LACROIX, A.FUENTES and H THONIER; Editions Eyrolles,Paris. Pratique du BAEL' ; J.PERCHAT et J.ROUX ; Editions Eyrolles,Paris.
Beton arme calcul des ossatures ;Albert fuentes ; Editions Eyrolles,Paris.

Semester: 3
Teaching : UET 2.1
Course Title 1: Documentary research and memoir conception
Total Hours: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Course Objectives:

Give students the tools they need to find useful information and use it in their final project. Help them through the various stages involved in writing a scientific document. Emphasize the importance of communication and teach students how to present their work in a rigorous and educational manner.

Recommended prior knowledge:

Writing methodology, Presentation methodology.

Contents:

Part I : Documentary research :

Chapter I-1: Defining the subject **(02 Weeks)**

- Subject title
- List of keywords related to the topic
- Gather basic information (acquisition of specialized vocabulary, meaning of terms, linguistic definitions)
- The information you need
- Take stock of your knowledge in the field

Chapter I-2: Selecting information sources **(02 Weeks)**

- Type of document (Books, Theses, Dissertations, Periodical articles, Conference , Audiovisual documents...)
- Type of resources (libraries, Internet...)
- Evaluate the quality and relevance of information

Chapter I-3: Locating documents **(01 Week)**

- Search techniques
- Search operators

Chapter I-4: Information **(02 Weeks)**

- Work organization
- Starting questions
- Summary of selected documents
- Links between different parts
- Final document search plan

Chapter I-5: Presentation of the bibliography **(01 Week)**

- Systems for presenting a bibliography (The Harvard system, The Vancouver system, The mixed system...)
- Presentation of documents.
- Quoting sources

Part II: Memory design

Chapter II-1: Dissertation plan and stages **(02 Weeks)**

- Identify and define the subject (Summary)
- Problem and objectives of the dissertation
- Other useful sections (Acknowledgements, Table of abbreviations...)
- The introduction (*writing the introduction last)*
- Literature review
- Formulating hypotheses
- Methodology
- Results
- Discussion
- Recommendations
- Conclusion and outlook
- Table of contents
- Bibliography
- The appendices

Chapter II- 2: Writing techniques and standards **(02 Weeks)**

- Formatting. Chapter, figure and table numbering.
- The cover page
- Typography and punctuation
- Writing. Scientific language: style, grammar, syntax.
- Spelling. Improvement of general language skills in terms of comprehension and expression.
- Save, secure and archive data.

Chapter II-3: Workshop: Critical study a manuscript **(01 Week)**

Chapter II-4: Oral presentations and defense **(01 Week)**

- How to present a Poster
- How to present an oral communication.
- Defending a dissertation

Chapter II-5: How to avoid plagiarism? **(01 Week)**

(Formulas, sentences, illustrations, graphs, data, statistics)

- The quote
- Paraphrasing
- Indicate complete bibliographical reference

Assessment :

Final Exam: 100%.

References :

1. *M. Griselin et al, Guide de la communication écrite, 2nd edition, 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.*