الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research
اللجنة البيداووية الوطنية لميدا العلوو والتكجولوويا
National Teaching Committee for Science and Technology

HARMONISATION OF ACADEMIC MASTER'S COURSES

2016 - 2017

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

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National Teaching Committee for Science and Technology

مواءمة

عرض تكوين
ماستر أكاديمي

2017-2016

الميدان	الفرع	التخصص
علوم وتكنولوجيا	هندسة مدنية	هياكل

I - Master's degree profile

Access conditions

Channel	Harmonised Masters	Degrees leading to a master's degree	Classification according to licence compatibility	Coefficient allocated to the licence
Civil engineering	**Structures**	Civil engineering	**1**	**1.00**
		Public works	**2**	**0.80**
		Mechanical engineering	**3**	**0.70**
		Other licences in the ST field	**5**	**0.60**

II - Semester organisation sheets for the speciality courses

Semester 1: Master Structures

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semester Hours (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method	
	Title			**Courses**	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course 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%
Foundation course 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%
Methodology course 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	3	2	1h30		1h00	37h30	37h30	40%	60%
UE Discovery Code : UED 1.1 Credits: 2 Coefficients: 2	Choice of subject 1	1	1	1h30			22h30	02h30		100%
	Choice of subject 2	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**	**13h00**	**7h30**	**4h30**	**375h00**	**375h00**		

Semester 2 Master Structures

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semester (15 weeks)	Additional consultancy work (15 weeks)	Assessment method	
	Title			**Courses**	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course 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%
Foundation course Code : UEF1.2.2 Credits: 8 Coefficients: 4	Reinforced concrete structures 2	4	2	1h30	1h30		45h00	55h00	40%	60%
	Foundations and supports	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodology course Code : UEM 1.2 Credits: 9 Coefficients: 5	Finite element methods	5	3	1h30		2h30	60h00	65h00	40%	60%
	Steel construction project	4	2	1h30	1h30		45h00	55h00	60%	40%
UE Discovery Code : UED 1.2 Credits: 2 Coefficients: 2	Choice of subject 3	1	1	1h30			22h30	02h30		100%
	Choice of subject 4	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 1.2 Credits: 1 Coefficients: 1	Ethics, professional conduct and intellectual property	1	1	1h30			22h30	02h30		100%
Total semester 2		**30**	**17**	**15h00**	**7h30**	**2h30**	**375h00**	**375h00**		

Semester 3 Master Structures

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semester Hours (15 weeks)	Complementary work in Consultation (15 weeks)	Assessment method	
	Title			**Courses**	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course 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%
Foundation course 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%
EU Methodological Code: UEM 2.1 Credits: 9 Coefficients: 5	Modelling structures	3	2			2h30	37h30	37h30	100%	
	Reinforced concrete structures project	6	3	1h30	3h00		67h30	82h30	60%	40%
UE Discovery Code : UED 2.1 Credits: 2 Coefficients: 2	Choice of subject 5	1	1	1h30			22h30	02h30		100%
	Choice of subject 6	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 2.1 Credits:1 Coefficients: 1	Documentary research and brief design	1	1	1h30			22h30	02h30		100%
Total semester 3		**30**	**17**	**13h30**	**9h00**	**2h30**	**375h00**	**375h00**		

UE Discovery ***(S1, S2, S3)***

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

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

Semester 4

In-company work placement, culminating in a dissertation and oral presentation.

	VHS	Coeff	Credits
Personal work	550	09	18
Work placement	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
- Writing the dissertation (Assessment by the jury) /4
- Presentation and answers to questions (Jury's assessment) /4
- Framer's assessment /3
- Presentation of the placement report (Assessment by the jury) /3

III - Detailed timetable by subject for semester S1

Semester:1
Teaching unit: UEF 1.1.1
Subject1:Structural Mechanics VHS:
45h00 (Class: 1h30, Practical work:
1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The proposed programme will enable students to strengthen their knowledge of structural calculus and acquire matrix and iterative methods for solving hyperstatic systems.

Previous knowledge recommended:

Notions of applied mathematics, strength of materials.

Subject content:

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

Chapter 2: Differential relations, calculation of arrows and rotations, internal potential theory, Castigliano theorem, Menabrea statement **(3 weeks)**

Chapter 3: Force method **(2 weeks)**
(Notion of superabundant internal connection, methods of simplification of calculation: method of the elastic centre, case where the stress 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)**

Assessment method:

Continuous assessment: 40%; examination: 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 resistance 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
Subject2:Dynamics of Structures 1
VHS: 45h00 (Class: 1h30, Practical work: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The aim of this course is to present the methods used to calculate the behaviour 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.

Previous knowledge recommended:

Strength of Materials; Numerical Methods.

Subject content:

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

- Definition of a dynamic problem
(Dynamic loading, Dynamic structure or system, Degrees of freedom of a system, Generalized coordinates)
- General procedure for a dynamic analysis
(Modelling in dynamics, Formulating the equation of motion, Solving the differential equations of motion, Interpreting and exploiting the 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 movement of a support
(Harmonic excitation of the substrate, Seismic excitation of the substrate)
- Response spectrum

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

- Formulation of the equations of motion
- Evaluation of matrices [M], [K], [C] and force vector {P}
(Stiffness matrix [K], Mass matrix [M], Damping matrix [C], External force vector {P})

Assessment method :

Continuous assessment: 40%; examination: 60%.

References :

1 ***J. BETBEDER-MATIBET and J.L. DOURY*** *Constructions parasismiques, Techniques de l'Ingénieur, traité Construction.*
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. Centre 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
Subject1:Reinforced Concrete Structures 1 VHS: 45h00 (Lectures: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching 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.

Previous knowledge recommended:

Resistance of materials, Reinforced concrete

Subject content:

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

- Description and construction of slab floors
- Description and construction of mushroom floors
- Calculating slabs

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

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

- Introduction
- Distribution of vertical loads on sleepers
- Calculation of gantries using the Caquot method
- Combination of loads and determination of maximum moments on beam supports and in spans

Chapter 3: Design of portal frames under horizontal loads **(3 weeks)**

- Introduction
- Concept of the centre of torsion
- Distribution of horizontal level forces on portal frames using the centre of torsion method
- Calculation of portal frames under horizontal forces using the Muto method

Chapter 4: Regulatory provisions relating to columns and beams **(3 weeks)**

- Combinations of actions (BAEL and RPA 99)
- Regulatory provisions relating to poles
- Regulatory provisions relating to beams

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

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

Assessment method:

Continuous assessment: 40%; examination: 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
Subject2:Metal Structures VHS:
67h30 (Lectures: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

On completion of this course, the knowledge acquired should enable the student t o correctly dimension the structural elements of a metal frame structure.

Previous knowledge recommended:

To be able to follow this course, you need to know about: the materials used in CM; the basis for calculating frameworks in CM; the strength classes of cross-sections; the design strengths of cross-sections and elements; assemblies.

Subject content:

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

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)**
(Classification of overhead travelling cranes, Actions on the running girder, Calculation of the running girder, Braking beams, Resistance to shear buckling, Resistance of webs to transverse loads)

Chapter 4: Mixed floors **(3 weeks)**
(Design and calculation of the composite beam, Calculation of the connection)

Chapter 5: Structural steelwork **(2 weeks)**
(Industrial buildings in metal framework, Multi-storey buildings in metal framework)

Chapter 6: Analysis methods for structural steelwork **(2 weeks)**
(Classification of structures, Choice of analysis method, Taking account of imperfections when calculating loads)

Assessment method:

Continuous assessment: 40%; examination: 60%.

Bibliographical 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 Dimensioning of Mixed Steel-Concrete Structures.*
5. *EUROCODE N°3 - Structural steel design - Part 1-8: Design of connections*

Semester:1
Teaching unit: UEM1.1
Subject1:Complementary programming
VHS: 45h00 (Class: 1h30, Practical work: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This course aims t o deepen students' knowledge of advanced programming.

Previous knowledge recommended:

General computing, programming language

Subject content:

Chapter 1: Reminder of programming techniques and programme structuring **(3 weeks)**
Chapter 2. Use of procedures and functions **(4 weeks)**
Chapter 3. Modular programming **(4 weeks)**
Chapter 4: Application examples **(4 weeks)**

Assessment method:

Continuous assessment: 40%; examination: 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 " Tome 2, Masson, 1975*

Semester:1
Teaching unit: UEM1.1
Subject2:Experimental methods VHS:
22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:
This subject provides students with experimental tools for the rheological and mechanical characterisation of certain materials and their durability.

Previous knowledge recommended:
Building materials taught in undergraduate courses

Subject content:

Chapter 1: Tests on self-placing concrete in the fresh state **(5 weeks)**
- Abrams cone spread
- L-shaped box
- Sieve stability

Chapter 2: Durability test on concrete **(5 weeks)**
- Chemical attacks
- carbonation-induced corrosion

Chapter 3: Mechanical tests on mortars and concretes and use of materials Mortar and concrete with portland cement and cement substitutes **(5 weeks)**

Assessment method:
Continuous assessment: 100%; Examination: 0%.

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
Subject3:Innovative materials
VHS: 37h30 (lectures: 1h30, practical work: 1h00)
Credits: 3
Coefficient: 2

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

Previous knowledge recommended:
Building materials taught in undergraduate courses

Subject content:

Chapter 1: Eco-Materials **(3 weeks)**
- Recovering materials :
- Natural materials (stone, clay for stabilised 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: STEP, animal meal, recycled glass)

Chapter 2. Alternative binders and substitute products **(4 weeks)**
- Organic binders: clay s t a b i l i s e r s
- 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
Fibre concrete

Chapter 4: Building materials **(4 weeks)**
- Improving HPC, BTHP and UHPC prefabrication processes
- Low pH concrete
- Injection grout

Assessment method:
Continuous assessment: %; 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
Subject 1: Technical English and terminology
VHS: 22h30 (1h30 lecture)
Credits: 1
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

Basic English vocabulary and grammar

Subject content:

- Reading comprehension: Reading and analysis of texts relating to the subject.

- Listening comprehension: Using authentic popular science videos, take notes, summarise 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 applying for work placements or jobs.

Recommendation: It is strongly recommended that the subject leader presents and explains at the end of each session (at most) ten or so technical words from the speciality in the three languages (if possible) English, French and Arabic.

Assessment method:

Review: 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 Subject1:
Elasticity
VHS: 67h30 (Classes: 3h00, Workshops: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:
To provide students with calculation methods enabling them to analyse the mechanical functioning of structures, to design them soundly, and to have the basic skills needed to use software.

Previous knowledge recommended:
Basic knowledge of mathematics and strength of materials.

Subject content:
Chapter 1: Introduction to the theory of elasticity **(1 week)**
(General information o n 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: Theory of the deformation state **(1 week)** (General, Deformation tensor, Relationship between deformations and displacements, deformations and principal directions, Geometric representation (Mohr's tri-circle), Deformation compatibility equation, Deformation measurement)

Chapter 4: Stress-strain relationships and behaviour laws **(2 weeks)**
(Generalised 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)**

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

Bibliographical 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. *Calculation of structures. COURBON (J.). Dunod (1972).*

Semester: 2
Teaching Unit: UEF 1.2.1 Subject 2:
Dynamics of Structures II VHS: 45h00
(Lectures: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives :

The aim of this course is to teach the behaviour of civil engineering structures, making use of several methods used in the dynamic analysis of civil engineering structures and works.

Recommended prior knowledge:

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

Contents :

Chapter 1: S.P.D.D.L. free vibrations **(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 spectrum, Calculation of modal seismic forces, Combination of modal responses, Applications)

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

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

Assessment method:

Continuous assessment: 40%; examination: 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. Centre 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 Subject1 :
Reinforced Concrete Structures 2 VHS:
45h (Lectures: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives :

The programme for the reinforced concrete structure subject (2) complements the same subject in S1. The student must be able to choose and use the calculation methods appropriate to 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)**

Sole on a pile, and several piles; General rafts

Assessment method:

Continuous assessment: 40%; examination: 60%.

Bibliographical 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. *BAEL 91 rules, "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, Bracing of buildings using walls. O.P.U.*
8. *ALBIGÈS (M.) and GOULET (J.). - Bracing of buildings. 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, volume 2, 3 and 4. Published by Eyrolles.*

Semester: 2
Teaching unit: UEF 1.2.2 Subject2:
Foundations and Supports VHS: 45h00
(Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This subject will enable students to learn about the different types of foundations and to determine their bearing capacity. It will also help the student to become familiar with the design and calculation of certain retaining structures and the stabilisation and reinforcement of sloping ground.

Previous knowledge recommended:

Soil mechanics subjects in semesters 4, 5 and 6 of the Civil Engineering, Resistance of Materials degree

Subject content:

Chapter 1: Background Shear strength of soils **(2 weeks)**

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

Chapter 2: Designing shallow foundations **(4 weeks)**

- Failure modes, Bearing capacity theory and calculation of bearing capacity for different types of surface foundations and different types of loading, Calculation of permissible stress, Calculation of settlements

Chapter 3: Calculation of deep foundations **(4 weeks)**

- Types of deep foundations, Construction methods and methods for calculating the load-bearing capacity of a single pile and a group of piles (Static method, Driving formula, Penetrometer and pressuremeter tests), Positive and negative lateral friction, Calculation of the permissible stress, Deep foundation project.

Chapter 4: Retaining structures and reinforcement **(5 weeks)**

- Classification of retaining structures

(Weight walls, Reinforced concrete walls, Sheet piling, Moulded walls, Reinforced earth walls)

- Calculation of actions and stresses, Design and justification of retaining structures
- Introduction to slope soil reinforcement methods

Assessment method:

Continuous assessment: 40%; examination: 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 Subject 1:
Finite element methods VHS: 37h30
(TP: 2h30)
Credits: 3
Coefficient: 2

Teaching objectives:

The objective of this course is to teach the finite element method as a method of solving problems in Mechanics (Civil Engineering in particular) governed by partial differential equations with boundary conditions. The aim is to make the student understand how the method works in order to master its use in software (Numerical Modelling).

Previous knowledge recommended:

Numerical Methods; Strength of Materials; Elasticity.

Subject content:

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

Reminder of the equations of equilibrium of an elastic solid
Exact solutions Vs Approximate resolution

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

- Spring element (Direct method stiffness matrix, Assembly, boundary conditions, resolution)
- Bar element and lattice system (Variational formulation (strong and weak), Type of element (shape function), Rigid matrix using the virtual work principle, Assembly, transformation matrix, boundary conditions, resolution)
- Finite Element Beam and Portal (Variational formulation (strong and weak), Type of element (Form function), Stiffness matrix by minimisation of potential energy, Assembly, transformation matrix, boundary conditions, resolution)

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

- Interpolation and shape functions (3-node triangular element; 6-node triangular element; 4-node quadrangular element; 4-node tetrahedral solid element; 8-node rectangular solid element).
- Construction of the stiffness matrix (Triangular element with 6 nodes; Quadrangular element with 4 nodes; Tetrahedral solid element with 4 nodes)
- Finite element bending of plates

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

- Construction of the finished element in One Dimension
- Generalisation for three-dimensional problems.

Assessment method:

Continuous assessment: 100% .

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 Subject: Steel construction project VHS: 67h30 (1h30 for lectures and 3h00 for tutorials)
Credits: 6
Coefficient: 3

Teaching objectives:
The aim of the subject is to direct students to design and calculate a structural steelwork project. The project takes the form of a workshop in which the teacher will direct the students to apply the various theoretical knowledge of steel structures to design and calculate a project.

Previous knowledge recommended:
Metal construction, Metal structures.

Subject content:

Chapter 1: Gathering and formulating preparatory information : **(2 weeks)**

(Project data, Study objectives, Regulatory requirements, Construction product data sheets)

Chapter 2: Design of a main framework for a hall building **(2 weeks)**

Chapter 3: Design of roof and façade structural elements **(2 weeks) Chapter 4:** Assessment of snow and wind loads on the building **(2 weeks)**

Chapter 5Sizing metal load-bearing elements for roofs and façades **(1 week)**

Chapter 6: Static analysis of transverse frames and dimensioning of main elements **(2 weeks)**

Chapter 7: Study of lattice bracing systems **(1 week)**

Chapter 8: Design and dimensioning of some connections **(2 weeks)**

Chapter 9: Preparing the graphic file for the execution work **(1 week)**

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

References :

1. *DTR BC 2.44, Règles CCM97 de conception et du calcul des structures en acier, published by the CGS national centre, Algiers, 1998,*
2. *D.T.R 2-4.7, Rules defining the effects of snow and wind on constructions "R.N.V.1999", published by the CNERIB national centre, Algiers, 2000*
3. *Dahmani L., Calcul des éléments résistants d'une structure métallique, published by OPU, Algiers, 2009,*
4. *Hirt M., Crisinel M., Charpentes Métalliques, Volume 11 of the TGC treatise, published by 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
Subject: Ethics, professional conduct and intellectual property
VHS: 22:30 (Course: 1:30)
Credit : 1
Coefficient: 1

Teaching objectives:

Develop students' awareness of ethical principles. Introduce them to the rules governing life at university (their rights and obligations vis-à-vis the university community) and in the world of work. Make them aware of the need to respect and value intellectual property. Explain to them the risks of moral evils such as corruption and how to combat them.

Recommended prior knowledge:

No

Contents :

A- Ethics and professional conduct

- **Notions of Ethics and Deontology (3 weeks)**

1. Introduction
   1. Definitions: Morals, ethics, deontology
   2. Distinction between ethics and deontology
2. MESRS Charter of Ethics and Professional Conduct: Integrity and honesty. Academic freedom. Mutual respect. Requirement of scientific truth, Objectivity and critical spirit. Fairness. Rights and obligations of students, teachers, administrative and technical staff.
3. Ethics and professional conduct in the workplace
   Legal confidentiality within the company. Loyalty to the company. Responsibility within the company, Conflicts of interest. Integrity (corruption in the workplace, its forms, consequences, methods of combating it and sanctions).

- **Research with integrity and responsibility (3 weeks)**

1. Respect for ethical principles in teaching and research
2. Teamwork responsibilities: Equal treatment in the workplace. Combating discrimination. Looking after the general interest. Inappropriate behaviour in the context of teamwork
3. 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.

B- Intellectual property

I- Fundamentals of intellectual property (1 week)

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

II- Copyright law (5 weeks)

1. Copyright in the digital environment

Introduction. Database copyright, software copyright and the specific case of open source software.

2. Copyright on the Internet and e-commerce

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.

4. Trademarks and designs

Definition. Trademark law. Design law. Appellation of origin. Secrecy. Infringement.

5. Geographical indications law

Definitions. Protection of geographical indications in Algeria. International treaties on geographical indications.

III- Protection and promotion of intellectual property (3 weeks)

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

Assessment method :

Examination: 100

References:

1. Charter of academic ethics and professional conduct, https://www.mesrs.dz/documents/12221/26200/Charte+fran ais+d f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Order No. 933 of 28 July 2016 laying down rules on preventing and combating plagiarism
3. C o p y r i g h t 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, n° 17
12. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.
13. Galloux, J.C., Droit de la propriété industrielle. Dalloz 2003.
14. Wagret F. et J-M., Brevet d'invention, marques et propriété industrielle. PUF 2001
15. Dekermadec, Y., Innover grâce au brevet: une révolution avec internet. Insep 1999
16. AEUTBM. The engineer at the heart of innovation. Belfort-Montbéliard University of Technology
17. Fanny Rinck andléda 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, Citing sources, IAE Nantes 2008
19. Similarity detection software: a solution to electronic plagiarism? Report of the Working Group on Electronic Plagiarism presented to the CREPUQ Subcommittee on Pedagogy and ICT
20. EmanuelaChiriac, 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 Montréal publication, Strategies for preventing plagiarism, Integrity, fraud and plagiarism, 2010.
22. Pierrick Malissard, Intellectual property: origin and evolution, 2010.
23. The 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
Subject1: Prestressed Concrete
VHS: 67h30 (Lecture: 3h, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

The aim of this subject is to give students the knowledge they need to study pre-stressed and post-stressed concrete beams.

Previous knowledge recommended:

Mathematics, RDM, MDC and reinforced concrete.

Subject content:

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

Chapter 2: **Materials and equipment used in prestressed concrete(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 post-tensioning prestressing losses, Pre-tensioning tension losses, Instantaneous and delayed losses, Characteristic values of prestressing reinforcement tensions.

Chapter 5: **Bending of isostatic beams** **(3 weeks)**
General, Resisting sections, Actions and loads, Classes of verification, ELS bending design, Important concepts, Design of sections in classes I and II, Design of sections in classes III, ULS bending design, Equilibrium of a section in ULS, Characterisation 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 using the internal method, Calculation of prestressing loads using the direct method

Chapter 6**: Tangent Stress Resistance** **(2 weeks)**
Resistance to shear force, Effects of shear force, Reduction of shear force, Calculation of shear stress, Verification of shear force at ELS and ELU, Resistance to torsion, Important concepts, Behaviour of a B.A or B.P beam with respect to torsion, Verification of torsion at ELS and ELU.

Chapter 7**: Justification of special sections** **(1 week)**
Introduction, Support zone, Post-tensioning introduction zone, Pre-tensioning introduction zone.

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

Bibliographical references:

1. Practical course on prestressed concrete by G.DREUX.
2. Pre-stressed 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
Subject2:Plasticity and damage VHS:
45h00 (1h30 for lectures, 1h30 for
practical exercises)
Credits: 4
Coefficient: 2

Teaching objectives:

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

Previous knowledge recommended:

Elasticity; Mechanics of Continuous Media; Strength of Materials.

Subject content:

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

(Notion of behaviour laws, Need for plastic calculations)

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

Plastic traction Plastic
bending

- Notions of plastic ball joint and Moment-curvature
- Study of homogeneous sections with axes of symmetry
- Study of reinforced concrete sections

Determination of capacity curves (Force-Displacement) of structures (trusses, beams, portals) by incremental analysis

Chapter 3. Limit analysis applied to structural design **(5 weeks)**

Principle of limit analysis
The theorems of limit analysis

- Static theorem
- Kinematic theorem

Application to structural failure load calculations
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 models
- Structural damage (concept of damage index, local-global damage relationship)

Assessment method:

Continuous assessment: 40%; examination: 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
Subject1:Earthquake engineering
VHS: 45h (Lectures: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To provide students with knowledge of earthquake engineering so that future managers are able to use the usual methods of earthquake-resistant calculations, taking into account the regulations in force (RPA 99 - version 2003 and Eurocode 8-1).

Recommended prior knowledge

- Dynamics of structures 1 and 2, Reinforced concrete structures 1 and 2, Steel structures.

Contents :

Chapter 1: Elements of seismology (2 weeks)

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

Chapter 2: Seismic protection objectives and design methods (1 week)

- Behavioural objectives
- Dimensioning methods
- Principles of verification
- Design principles

Chapter 3: Characteristics of earthquake-resistant buildings(2 Weeks)

- Basic design principles
  - A simple structure
  - Uniformity, symmetry and hyperstaticity
  - Strength and rigidity in both directions (effect of torsion)
  - Action of the diaphragms on the stages
  - Suitable foundations
- Structure regularity criteria
  - Planarity criteria
  - Elevation regularity criteria

Chapter 4: Classification criteria (1 week)

- Seismic zones - zone acceleration coefficient
- Structures by size
- Locations - average dynamic amplification factor
- Bracing systems - overall behaviour coefficient of the structure

Chapter 5: Seismic force calculation rules - Equivalent static method (3 weeks)

- Conditions of application - Principle - Modelling
- Calculation of total seismic force - Distribution of seismic force according to height (storeys)
- Accidental torsion effects
- Horizontal distribution of seismic forces on bracing members -
- Safety justification - combinations of actions

Chapter 6: Spectral modal dynamics method (3 weeks)

- Principle - Modelling - Calculation response spectrum - Calculation of seismic forces.
- Requirements common to both methods :

- Rollover stability.
- Travel calculations.
- Safety justification.

Chapter 7: Ductility concept and constructive provisions (2 weeks)

- Concept of ductility and introduction to capacity-based dimensioning.
- Constructive measures
  - Special specifications for structural elements.
  - Additional requirements for non-structural elements.

Assessment method:

Continuous assessment: 40%; examination: 60%.

Bibliographical 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 behaviour 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
Subject2:Special works
VHS: 45h00 (Lectures: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This course deals with the design, dimensioning and reinforcement of certain non-building structures in accordance with EuroCode EC2.

Previous knowledge recommended:

Resistance of materials, Reinforced concrete.

Subject content:

Chapter 1: Retaining walls **(3 weeks)**

Chapter 2 : Cupolas **(2 weeks)**

Chapter 3 : Silos **(3 weeks)**

Chapter 4: Reservoirs and water towers **(3 weeks)**

Chapter 5: Reinforced concrete bridges **(2 weeks)**

Chapter 6 : Industrial halls **(2 weeks)**

Assessment method:

Continuous assessment: 40%; examination: 60%.

Bibliographical references:

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

Semester:3
Teaching unit: UEM 2.1
Subject2:Structural modelling VHS:
37h30 (TP: 2h30)
Credits: 3
Coefficient: 2

Teaching objectives:

This course introduces the fundamental principles of modelling some civil engineering structures or elements of structures using finite element software (SAP, Robot Structural Analysis, ETABS, etc.).

Previous knowledge recommended:

Basic principles of the finite element method, notions of reinforced concrete, notions of seismic and wind studies.

Subject content:

Chapter 1: Introduction to civil engineering software

Chapter 2: Stages in the modelling o f a structure using the software;

Chapter 3: Modelling a reinforced concrete structure (residential or office building);

Chapter 4: Modelling a steel frame structure (industrial shed).

Assessment method:

Continuous assessment: 100%.

Bibliographical references:

- T e a c h e r - p r e p a r e d handout.
- Regulatory technical document (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
Subject1: Reinforced concrete structures
project VHS: 67h30 (Class: 1h30, Practical: 3h00)
Credits: 6
Coefficient: 3

Teaching objectives:

The aim of this subject is t o develop all the stages o f a project for calculating structures under the supervision of the teacher responsible for the subject.
Applying knowledge in a design office situation

Previous knowledge recommended:

Strength of Materials - Structural Mechanics - Plastic Analysis of Structures - MEF - Reinforced Concrete - Elasticity - Structural Modelling.

Subject content:

Presentation and description of the project
Overview of the different stages in calculating a project Calculation assumptions
Materials used
Standards and regulations used
Choice of load-bearing system (mixed structures: walls + portals)
Pre-dimensioning of structural elements and evaluation of loads Dimensioning of floors
Calculation of secondary elements (balcony, acroterion)
Seismic study
Study of structures in relation to wind
Calculation and reinforcement of staircases
Calculation and reinforcement of the load-bearing structure Dimensioning of foundations.
Production of plans (formwork plan, reinforcement plan ....) for the calculated elements.
Conclusions and outlook

Assessment method:

Continuous assessment: 40%; Examination: 60%.

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 ; Albertfuentes ; Editions Eyrolles,Paris.

Semester: 3
Teaching unit: UET 2.1
Subject 1: Documentary research and dissertation design VHS:
22h30 (1h30 lecture)
Credits: 1
Coefficient: 1

Teaching objectives :
To give students the tools they need to find useful information and put it to better use in their end-of-studies project. Help them through the various stages involved in writing a scientific document. To emphasise the importance of communication and to teach students how to present their work in a rigorous and educational manner.

Recommended prior knowledge:
Writing methodology, Presentation methodology.

Subject content:

Part I : Documentary research :

Chapter I-1: Definition of the subject **(02 Weeks)**
- Subject heading
- List of keywords relating to the subject
- Gather basic information (acquisition of specialist vocabulary, meaning of terms, linguistic definitions)
- Information sought
- Take stock of your knowledge in the field

Chapter I-2: Selecting sources of information **(02 Weeks)**
- Type of document (books, theses, dissertations, periodical articles, conference proceedings, audiovisual documents, etc.)
- Type of resources (libraries, Internet, etc.)
- Assessing the quality and relevance of information sources

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

Chapter I-4: Processing information **(02 Weeks)**
- Organisation of work
- The initial questions
- Summary of documents selected
- Links between different parts
- Final plan for documentary research

Chapter I-5: Presentation of the bibliography **(01 Week)**
- Systems for presenting a bibliography (Harvard system, Vancouver system, mixed system, etc.)
- Presentation of documents.
- Quoting sources

Part II: Memory design

Chapter II-1: Plan and stages of the dissertation (02 weeks)

- Identifying and defining the subject (Summary)
- Issues and objectives of the dissertation
- Other useful sections (Acknowledgements, Table of abbreviations, etc.)
- The introduction (*Writing the introduction last)*
- Specialist literature
- Formulation of hypotheses
- Methodology
- Results
- Discussion
- Recommendations
- Conclusion and outlook
- Table of contents
- Bibliography
- The appendices

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

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

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

Chapter II-4: Oral presentations and defences (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, etc.)

- The quote
- Paraphrasing
- Indicate the complete bibliographical reference

Assessment method :

Examination: 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.*