PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

MASTER TRAINING OFFER

Professional Master

Establishment	Faculty / Institute	Department
Mohamed Khider Biskra University	**Faculty of Science and Technology**	**Civil and Hydraulic Engineering**

Domain	Sector	Speciality
Science and technology	**Civil Engineering**	**Calculation and technical control of constructions**

Academic year: 2021/2022

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

مواءمة

عرض تكوين ماستر

مهني

المؤسسة	الكلية/ المعهد	القسم
جامعة محمد خيضر بسكرة	كلية العلوم والتكنولوجيا	الهندسة المدنية والري

الميدان	الشعبة	التخصص
علومتكنولوجيا	هندسة المدنية	حساب ومراقبة تقنية للمنشات

السنة الجامعية:2022/2021

SUMMARY

I – Master's identity sheet
(All fields must be completed)

1 - Location of the training:

University	**Mohamed KHIDER - Biskra**
Faculty	**Science and Technology**
Department	**Civil and hydraulic engineering**

2- Training partners *:

- Businesses and other socio-economic partners:

The companies welcoming apprentices in the civil engineering sector are very diverse, with the missions offered covering the entire construction sector. Let us quote: Design office.Some private study and technical inspection laboratories.Cement plants (Lafarge)

See Appendices

3 – Context and objectives of the training

A – Access conditions*(indicate the license specialties which can give access to the Master)*

Bachelor's degree in academic civil engineering
Professional civil engineering degree.

Sector	Professional Master	Licenses giving access to the master's degree	Ranking according to license compatibility	Coefficient assigned to the license
Civil engineering	Calculation and technical control of constructions	Civil engineering	1	1.00
		Public works	2	0.800
		Mechanical construction	3	0.700
		Other licenses in the ST domain	4	0.60

B - Training objectives*(skills targeted, educational knowledge acquired at the end of the training - maximum 20 lines)*

The objective of the Professional Master's degree "Technical calculation and control of constructions" is to train executives capable of participating in the design, calculation and technical

control of constructions based on new technical regulations and to master the implementation of projects in the field of civil engineering. Also, resolve all the major problems posed by the construction, operation and maintenance of the works. The training also allows you to understand the overall framework of the project while taking into account its specificities. It thus deals with aspects linked to project management strategies and techniques, the roles and responsibilities of the different actors in a project and its specific legal framework.
The introduction of an end-of-studies project makes it possible to summarize what has been learned on concrete applications in the field of technical studies and control of structures. Professional training is supplemented by internships in companies or design offices.

C – Targeted job profiles and skills*(in matters of professional integration - maximum 20 lines):*

- Calculate and size a civil engineering structure;
- Mastery of construction control methods on site;
- Determine and analyze the risks linked to a construction operation and its operation;
- Advocate good practices in the implementation of construction techniques;
- Pathology and control of the durability of constructions;
- Manage a project and a customer relationship;
- Master the legislative, regulatory and normative aspects.

D- Regional and national employability potential of graduates

The areas of great interest to the planned training are, for the most part, linked to public or private activities whose mission is the calculation and technical control of constructions (design offices and building and public works companies).
The sectors that traditionally employ these graduates are:
- Industrial sectors: Design offices, public companies.
- Sectors of application: Engineering of works, technical control of cement quality in cement factories

E – Gateways to other specialties

The vertical gateway from the academic degree (Civil Engineering) to the master's degree will be open to students. The selection of students will be made based on file review by the training team concerned.

F – Training monitoring indicators

The teaching offered as part of the Master's degree is organized over a period of three semesters. It is completed by the completion of an end-of-studies thesis (Personal Tutored Project)
Student assessment is generally based on a continuous assessment system (Individual and collective work)followed by an exam and a make-up exam for students who have not completed 30 credits for each semester
Defense:
Finally, the final dissertation will be defended before a jury with a view to obtaining the Professional Master's degree "Calculation and Technical Control of Construction"
Classes will take place from Sunday to Thursday.
However, it is possible that some courses can take place on Saturdays.
Language :
The language of training is French.

G – Supervisory capacity(give the number of students that can be supported)

Supervision capacity: 25 students

*** = Courses, tutorials, practical work, internship supervision, dissertation supervision, other (to be specified)**

B: External supervision:

Home establishment:

Last name First Name	Graduation diploma + Specialty	Diploma Post graduation + Specialty	Grade	Type of intervention *	Registration

Home establishment:

Last name First Name	Graduation diploma + Specialty	Diploma Post graduation + Specialty	Grade	Type of intervention *	Registration

Home establishment:

Last name First Name	Graduation diploma + Specialty	Diploma Post graduation + Specialty	Grade	Type of intervention *	Registration

*** = Courses, tutorials, practical work, internship supervision, dissertation supervision, other (to be specified)**

5 – Specific material resources available

A- Educational Laboratories and Equipment: Sheet of existing educational equipment for the practical work of the planned training (1 sheet per laboratory)

Laboratory title: Construction Materials

Student capacity: 25

No.	Equipment title	Number	observations
01	Sieving bottom (Ø: 200 h: 50mm)	**04**	
02	0.020mm mesh opening sieve set	**04**	
03	Mesh opening sieve set 0.063mm	**04**	
04	Mesh opening sieve set 0.090mm	**04**	
05	0.125mm mesh opening sieve set	**04**	
06	Mesh opening sieve set 0.180mm	**04**	
07	0.250mm mesh opening sieve set	**04**	
08	0.355mm mesh opening sieve set	**04**	
09	Mesh opening sieve set 0.500mm	**04**	
10	Mesh opening sieve set 0.710mm	**04**	
11	1,000mm mesh opening sieve set	**04**	
12	Deval Machine (ASTM D2-3), Ball Set	**01**	
13	Analytical sieve (AS200)	**01**	
14	Alabrasion testing machine (Los-engeles) Ball set	**01**	
15	Complete Blain permeabilimeter	**04**	
16	Vicat device, needle Ø: 1mm, needle Ø: 1mm on foot and ebonite rings	**01**	
17	Forced mortar mixer with 5 liter tank with different beaters	**01**	
18	SBA 62 type balance	**01**	
19	SBA 62 type balance	**01**	
20	Portable Concrete Porosimeter	**01**	
21	Standard Joisel apparatus (complete box)	**01**	
22	Memmert WB7 water bath (7 liter)	**01**	
23	Compression testing machine (2000KN)	**01**	
24	Bending test kit and device (3 and 4 points)100KN sample/B	**01**	
25	Mortar specimen device (40x40x160mm)	**01**	
26	Vibrating table with control unit with clamping device for a triple mold	**01**	
27	Triple prismatic mold with base plate	**01**	
28	Triple mold riser, Hand tamper 150mm	**01**	
29	Spreading cone for measuring consistency	**03**	
30	Zinc plate spreading table	**01**	
31	Wooden plug (40x40mm)	**02**	
32	Portable depth gauge device	**01**	

34	Cylindrical concrete mold with base (Ø160mm h:320mm)	**06**	
35	Portable concrete sclerometer	**02**	
36	Le Chatelier hydrometer, capacity (250ml)	**05**	
37	Maneuverability device (high and very high): wooden spreading table covered with galvanized sheet metal, Mold (cone) and Pounding rod	**01**	
38	Large aluminum spoon	**02**	
39	Chain (ribbon03m)	**01**	
40	Wooden rammer (oar shape)	**01**	
41	Concrete handling device (low and very low)	**01**	
42	Ramming rod (Ø160mm L: 600mm)	**01**	
43	Digital stopwatch	**01**	
44	Complete sand equivalent apparatus	**02**	
45	Scheibler calcimeter according to DIN18129	**01**	
46	Sample divider of (2 cells of6 liters)	**01**	
47	Sample preservation tank (700 litres)	**01**	
48	Wooden slatted grill	**01**	
49	Heating unit by thermostat regulator	**01**	
50	Needle stopwatch (0-60min)	**01**	
51	Chemistry thermometer (-10 to 110°c)	**01**	
52	Max-min thermometer (-30 to +50°C) metal frame	**01**	
53	Graduated cylinder (1000 ml)	**01**	
54	UM600 oven with 02 stages (+30 to 220°c)	**01**	
55	Mono Centrifugal Ball Mill, Cylindrical Jar, Agate Balls (Ø=20m)	**01**	
56	Pulverisette type jaw crusher1-		
57	Universal thermometer (-10 to 360°c)	**01**	
58	Surfacing trowel	**01**	
59	Wire brush	**04**	
60	Wheelbarrow60 liters	**02**	
61	Can of10 liters	**01**	
62	Sheet metal spoon	**02**	
63	Brush	**01**	
64	Concrete mixer (100 liters)	**02**	
65	Triple steel sheet mold (40x40x160 mm)	**03**	
66	Triple steel sheet mold (70x70x280 mm)	**03**	

Laboratory title: Soil Mechanics

Student capacity: 25

No.	Equipment title	Number	observations
01	-Plasticity penetrometer -Container for test gauge test	**01** **01**	
02	-odometer cell -pressure indication panel	**01** **01**	

	-universal pump -volume loading unit -4-channel display unit - mounting of pressure screw - pressure panel -frame gauge	**01** **01** **01** **02** **01** **01**	
03	- static triaxial -Static triaxial cell -universal pump -water deaeration device - mounting of pressure screw -volume loading unit - pressure panel -4-channel display unit -dial gauge (50x0.01mm) -basic adapter	**03** **03** **03** **03** **06** **03** **03** **03** **02** **07**	
04	- dynamic triaxial -control unit -Triaxial cell -water deaeration device -pressure indication panel (100mm) -basic adapter -pressure transducer - displacement transducer	**03** **01** **01** **01** **03** **03** **04** **02**	
05	-compressor	**01** **03**	
06	-type UM 600 oven	**01**	
07	-Casagrande manual	**01**	
08	-Casagrande electric	**01**	
09	-pocket penetrometer	**04**	
10	-compaction machine	**01**	
11	-electric scale (SCALTEC)	**01**	
12	-balance type SBA.62	**01**	
13	-universal extruder	**01**	
14	-universal extraction system	**01**	
15	-hydraulic manual extruder	**01**	
16	-moving cone penetrometer	**01**	
17	-tassometer	**01**	
18	-sample collection equipment D=100mm	**01**	
19	Container with thermostat (cell for melting wax	**01**	
20	-universal mixer	**01**	
21	-water dilator	**01**	
22	- set of comparators (100mm-0.002mm 25mm-0.01mm	**05** **05**	

	50mm-0.01mm)	**05**	
23	-LCPC piezometer	**01**	
24	-inclinometer	**01**	
25	-compaction lady	**02**	
26	-cutting flow	**02**	
27	-universal shearing machine -all weights -1kn -2kn -5kn -10kn -dial gauge (100x0.02mm) -dial gauge (100x0.01mm)	**01** **01** **02** **01** **01** **01** **01**	
28	-dynamic penetrometer	**02**	
29	-combined permeametry	**01**	
30	-motorized augers	**01**	
31	-in-situ scisometer with additional equipment	**02**	
32	-sand density meter	**01**	
33	- change test with cylinder -Dial gauge-(50x0.01)	**01** **04**	
34	-dynamic ring -4.5kn -28kn -50kn -10kn -3kn -2kn	 **05** **01** **02** **02** **01** **03**	
34	Stainless steel sieve	**11**	
35	Sieve	**14**	
36	rach 19 inverters	**01**	
37	-normal pressureometer test -probe diameter 60mm rubber sheath -probe diameter 60mm metal sheath -probe shoe -probe connection -HP 25m coaxial tuber -HP 25m coaxial tuber -HP nitrogen bottle regulator -coaxial socket -bottle connection -d63 hand screw with aG turn -metal sheath d60mm -membrane d60mm -probe seal -rubber ring -membrane ring -probe mounting bracket -strap key	**01** **01** **01** **01** **01** **01** **01** **01** **01** **01** **01** **05** **10** **01** **02** **02** **01** **01**	

	-Diaphragm -clamp -rod 9x22 L=1m	**02** **01** **15**	
38	-tamix stainless steel d305mm80µm -stainless steel tamix	**14** **11**	
39	-Rebar detector with probe -control block	**01** **01**	
40	-concrete sclerometer	**01**	

Laboratory title: Hydraulics
Student capacity: 25

No.	Equipment title	Number	observations
01	Fundamental Hydrology Study System (Armfield)	**01**	
02	Hydraulic pump	**01**	
03	KDG 2000 flow meter	**01**	
04	Weather station	**01**	
05	Compact 0.5-50m/s anemometer	**01**	
06	Compact 0-360° wind sensor	**01**	
07	Hygrothermometer RH 0-100%.T-20°/-80°	**01**	
08	Rain gauge	**01**	
09	Central acquisition	**01**	
10	256 KB memory card	**01**	
11	Reading device	**01**	
12	Acclomate battery	**01**	
13	Accumulator	**01**	
14	Laminar flow tank (Armfield)	**01**	
15	Combi 2 curvimeter	**05**	
16	Turbidimeter 2100P (HACH)	**01**	
17	Programmable sampler	**01**	
18	Dryfit accumulator	**01**	
19	Battery charger	**01**	
20	Syscal Junior 400 V resistivometer	**01**	
21	Battery charger	**01**	
22	PC transfer cable and software	**01**	
23	Software key	**01**	
24	Measuring cable 2x0.5 LICY gray	**01**	
25	Electric pliers	**02**	
26	Polarizing microscope	**01**	
27	Polarizing microscope	**01**	
28	Stereo binocular magnifier	**01**	
29	Case for water analysis	**01**	
30	Conductivity tester	**01**	
31	Succhi disc	**01**	
32	Solar calculator	**01**	
33	380-720nm filter photometer		
34	Manual sampler 2000ml		

Laboratory title: Topography

Student capacity: 25

No.	Equipment title	Number	observations
01	NI40 comparator level	**01**	
02	NI40 comparator level	**01**	
03	NI40 comparator level	**01**	
04	Aluminum tripod	**01**	
05	Aluminum tripod	**01**	
06	Aluminum tripod	**01**	
07	ZEISS Eth50 Theodolite	**01**	
08	ZEISS Eth50 Theodolite	**01**	
09	ZEISS Eth50 Theodolite	**01**	
10	TOPCOM wooden tripod	**01**	
11	TOPCOM wooden tripod	**01**	
12	TOPCOM wooden tripod	**01**	
13	Aluminum telescopic sight, graduated in mm	**01**	
14	Aluminum telescopic sight, graduated in mm	**01**	
15	Aluminum telescopic sight, graduated in mm	**05**	
16	Battery charger for Eth50	**01**	
17	Battery charger for Eth50	**01**	
18	Battery charger for Eth50	**01**	
19	NIKON NE 20S electronic theodolite	**01**	
20	Laser distance meter (disto-basic)	**01**	
21	Viewfinder for basic distortion	**01**	
22	GLSP1 reflector cane	**01**	
23	1m extension for GLS11 cane	**01**	
24	GSR2 double counter plug	**01**	
25	GLS11 reflector	**02**	
26	Brown light	**01**	
27	NICD Battery Charger	**01**	
28	NEDO invar sight, 5mm, 3m	**01**	
29	NEDO invar sight, 5mm, 3m	**01**	
30	NEDO invar sight, 5mm, 3m	**01**	
31	Optical square, double prism	**10**	
32	Base, 3kg toad	**03**	
33	1m interlocking milestone	**10**	
34	Milestone tripod	**10**	

B- Internship sites and in-company training:

Training place	Number of students	Training period
Technical control study offices and organizations, cement plants	**25**	

C- Master's support research laboratory(ies):

Civil Engineering Research Laboratory (LRGC)

D- Master's support research project(s):

Title of the research project	Project code	Project start date	Project end date
Calculation of the limit load of geotechnical structures in Soil-Structure interaction using a numerical approach	A01L02UN070120180002	01/01/2018	12/31/2022
Valorization of local materials in construction	A01L02UN070120180004	01/01/2018	12/31/2022
Analysis of the behavior of composite material and FGM structures	A01N02UN070120190002	01/01/2018	12/31/2022
Experimental and numerical investigation of the effect of binders and fines on the mechanical behavior of powdery soils	A01L02UN070120180008	Dr.BENMEDDOUR Djamel	
Formulation, characterization and sustainability of bio-sourced composite materials	A01L02UN070120180001	01/01/2018	12/31/2022
Optimal design of simple and radiated structures using digital modeling	A01L02UN070120180003	01/01/2018	12/31/2022
Numerical study of the stability and load-bearing capacity of soils reinforced with geosynthetics and vertical inclusions	A01L02UN070120180005	01/01/2018	12/31/2022
Contribution of membrane and flexional finite elements based on the deformation approach for the modeling of structures	A01L02UN070120190005	01/01/2019	01/31/2023
Digital modeling of geotechnical structures	A01L02UN070120190004	01/01/2019	01/31/2023
Numerical simulation by retro-analysis of interacting geotechnical works	A01L02UN070120190001	01/01/2019	31/012023
Study of the effect of high temperature on the physical and mechanical properties of different types of	A01L02UN070120190003	01/01/2019	2023

concrete			
Probabilistic and Deterministic Numerical Analysis of the Stability and Bearing Capacity of Geotechnical Structures	A01L02UN070120200001	01/01/2020	01/31/2024
Assessment of Turbination Potential on Wastewater Systems	A17N01UN070120200003	01/01/2020	01/31/2024
Valorization of polymer products (plastic, latex) for the manufacture of different types of concrete and mortars	A17N01UN070120210001	01/01/2020	01/31/2024

E- Personal work spaces and ICT:

The department provides its teachers with offices as personal work spaces equipped with computer equipment and connected by an internet network also intranet. Also, two large consultation rooms are available to students outside of study hours. An Internet room and a calculation center equipped with 25 microcomputers are open to all students in the department.

II – Half-yearly teaching organization sheet

(Please present the forms for the 4 semesters)

1- Semester 1: Calculation and technical control of constructions

Teaching unit	VHS	Weekly VH				coefficient	Credits	Evaluation method	
	15 weeks	VS	T.D.	TP	Others			Continuous	Exam
Fundamental EU									
UEF (O/P)									
Reinforced concrete structures 1	67.5	1.5	3.0	0		3	6	40%	60%
Dynamics of structures	67.5	3.0	1.5	0		3	6	40%	60%
Elasticity	67.5	3.0	1.5	0		3	6	40%	60%
EU methodology									
EMU (O/P)									
Concrete formulation and quality	67.5	1.5	0.0	2.5		3	6	40%	60%
Binders	37.5	0.0	0.0	3		2	3	100%	
Discovery EU									
UED (O/P)									
Stability and reinforcement of the ground	45	1.5	1.5	0.0		2	2	40%	60%
Transversal EU									
UET1 (O/P)									
Technical English and terminology	22.5	1.5	0.0	0.0		1	1		100%
Total Semester 1	**375**	**13.50**	**6.0**	**5.5**		**17**	**30**		

2- Semester 2: Calculation and technical control of constructions

Teaching unit	VHS	Weekly VH				coefficient	Credits	Evaluation method	
	15 weeks	VS	T.D.	TP	Others			Continuous	Exam
Fundamental EU									
UEF (O/P)									
Reinforced concrete structure 2	67.5	3.0	1.5	0.0		3	6	40%	60%
Seismic design and analysis	67.5	3.0	1.5	0.0		3	6	40%	60%
Metallic structures	67.5	3.0	1.5	0.0		3	6	40%	60%
EU methodology									
EMU (O/P)									
Finite element method	67.5	1.5	0.0	3.0		3	6	40%	60%
Experimental methods	37.5	1.5	0.0	1.0		2	3	100%	
Discovery EU									
UED (O/P)									
Superficial and deep foundations	45	1.5	1.5	0.0		2	2	40%	60%
Transversal EU									
UET (O/P)									
Technical inspection of works	22.5	1.5	0.0	0.0		1	1		100%
Total Semester 2	375	**12.0**	**4.5**	**7.0**		**17**	**30**		

3- Semester 3: Calculation and technical control of constructions

Teaching unit	VHS	Weekly VH				coefficient	Credits	Evaluation method	
	15 weeks	VS	T.D.	TP	Others			Continuous	Exam
Fundamental EU									
UEF (O/P)									
Reinforced concrete structures	67.5	1.5	3.0	0.0	0.0	3	6	40%	60%
Prestressed concrete	67.5	3.0	1.5			3	6	40%	60%
Structures with metal frames and mixed structures	67.5	3.0	1.5	0.0	0.0	3	6	40%	60%
EU methodology									
EMU (O/P)									
Reinforced concrete structures project	67.5	1.5	0	3.0		3	6	40%	60%
TP Modeling and Analysis of structures	37.5	0	0	2.5		2	3	100%	
Discovery EU									
UED (O/P)									
Repair and rehabilitation of structures	4.5	3.00	0.0	0.0		2	2		100%
UED (O/P)									
Transversal EU									
UET (O/P)									
Project planning and management	22.5	1.5	0.0	0.0		1	1		100%
Total Semester 3	**37.5**	**13.5**	**6.0**	**5.5**		**17**	**30**		

4- Semester 4:

Domain : Science and technology
Sector : Civil Engineering
Speciality : Calculation and Technical Control of Constructions

Internship in a company culminating in a dissertation and a defense.

	VHS	coefficient	Credits
Personal work	150.0	5	10
Internship in company	150.0	10	16
Seminars	15.0	2	4
other (explain, list,)	- -	-	-
Total Semester 4	315.0	17	30

5- Overall summary of the training:(indicate the separate global VH in progress, TD, for the 04 semesters of teaching, for the different types of EU)

EU / V.H.	UEF	EMU	UED	UET	Total
Course	360	112.5	90	67.5	630
T.D.	247.5	0	67.5	0	315
TP	180	240	90	0	510
Personal work	315	0.0	0.0	0.0	
other (explain, list,)					
Total	1102.5	352.5	177.5	67.5	
Credits	72	36	8.0	4.0	**120**
% in credits for each EU	60.00	30%	6.67	3.33	100%

III - Detailed program by subject
(1 detailed sheet per subject)

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:UEF (O/P)
Title of the subject:Reinforced concrete structures 1
Credits: 6
Coefficients: 3

Teaching objectives: This subjectdeals with the practical methods of design and dimensioning of the different elements of construction:

Recommended prior knowledge(Resistance of materials and reinforced concrete).

Content of the material:

Chapter 1: Calculation of slab floors and mushroom floors

Description and constructive provisions of slab floors

- Description and constructive provisions of mushroom floors
- Calculation of slabs

(BAEL flat rate method, Pigeaud method, Break line method)

Chapter 2:Calculation of reinforced concrete frames under vertical loads

- Distribution of vertical loads on the sleepers
- Calculation of porticos using the Caquot method
- Combinations of stresses and determination of maximum moments on support of beams and in span

Chapter 3:Calculation of frames under horizontal loads

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

Chapter 4: Regulatory provisions relating to posts and beams

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

Chapter 5. Superficial foundations

- Footing under wall; Insulated sole under post;
- Running footing under posts; Write off.

Evaluation method:

Continuous monitoring: 40%; 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. Treaty of Reinforced Concrete'; by R LACROIX, A.FUENTES and H THONIER; Editions Eyrolles, Paris.

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:UEF (O/P)
Title of the subject: Dynamics of structures
Credits: 6
Coefficients: 3

Teaching objectives: The objective of the study of structural dynamics is to learn the model analysis of systems with a single and several degrees of freedom.

Recommended prior knowledge:
Strength of materials; Numerical methods.

Content of the material:

chapter 1 Introduction and generalists

- Definition of a dynamic problem

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

- Proceduregeneral of a dynamic analysis

(Dynamic modeling, Formulation of the equation of motion, Resolution of differential equations of motion, Interpretation and exploitation of results)

Chapter 2 : Single degree of freedom systems

- Formulation of the equation of motion
- Free vibrations

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

- Forced Vibrations

(Harmonic excitation, Impulsive excitation, Any dynamic excitation)

- Response to support movement

(Harmonic excitation of the support, Seismic excitation of the support)

- Response spectrum

Chapter 3: Systems with multiple degrees of freedom

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})

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

References :
Earthquake Engineering: Design and sizing of buildings
Pierino Lestuzzi, Marc Badoux – 2008
Elements of seismic engineering and structural dynamic calculation
André Filiatrault – 1996
Buildings in seismic zones: design of masonry buildings
Albert Fuentès - 1998

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:UEF (O/P)
Title of the subject:Elasticity
Credits: 6
Coefficients: 3

Teaching objectives:
Provide students with calculation methods allowing them to analyze the mechanical functioning of structures, design them soundly, and have the necessary foundations for using software.

Recommended prior knowledge:
Basic knowledge of Mathematics,Strength of materials.

Material content:
Chapter 1: Introduction to the theory of elasticity
(General information on elasticity, Rmathematical calls, Index notations)

Chapter 2: Stress state theory
(Stress tensor, Differential equations of equilibrium, Stress on a plane, Stresses and principal directions, Geometric representation (Mohr's tri-circle)

Chapter 3: Strain state theory
(General, Deformation tensor, Relations between deformations and displacements, deformations and principal directions, Deformation compatibility equation, Measurement of deformations)

Chapter 4: Relationship between stresses and strains

(Generalized Hooke's law, Influence of temperature, Deformation energy)

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

Chapter 6: Solving Plane Elasticity Problems
(AIRY function, Plane strain problem, Plane stress problem)

Chapter 7: Bending of Beams

Chapter 8: Study of thin plates

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Theory of Elasticity / Timoshenko and Goodier
2. Elasticity exercises / Caignaerd and JP Henry Editions: Dunod
3. Structural mechanics (volume 2) / François Frey Edition: EPFL Press
4. Plate and shell theory, Timoshenko Woinowsky-Krieger
5. Mathematical elasticity AE Love
6. Mechanics of continuous media Volume 3 Plates and shells
7. Theory of elasticity E. Green and W. Zerna.

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

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:EMU (O/P)
Title of the subject:Concrete formulation and quality
Credits: 6
Coefficients: 3

Teaching objectives:
Characterize mineral binders (plaster, lime and cement)

Recommended prior knowledge:
Physical and chemical properties of materials. Construction materials,mineral binders

Content of the material:
Chapter 1. Classification of binders and normative aspects
Chapter 2. Ordinary and compound cements
Chapter 3. Hydraulic lime
Chapter 4 Air lime
Chapter 5 Plaster

P 1.Tests on cements:
Setting test, laser particle size, loss on ignition, insoluble residue, fineness, density, analysis by fluorescence spectrometry, mineralogical analysis by x-ray diffraction
Determination of compressive strength
Determination of bending strength

TP 2.Hydraulic lime testing
Determining the start of setting
Determination of volume stability
Determination of compressive strength

TP3. Tests on aerial lime
Determination of calcium and magnesium oxide content
Determination of active lime content
Determination of quicklime reactivity
Determination of grinding fineness

TP 4 Tests on plaster
Determination of pouring and smoothing time
Determination of grinding fineness
Determination of compressive strength
Determination of bending strength
Determination of impurity content

Evaluation method:
Continuous monitoring: 40%; Review 60%.

Bibliographic references: To be defined by the teacher

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:EMU (O/P)
Title of the subject:TP Binders
Credits: 3
Coefficients: 2

Teaching objectives:
Characterize mineral binders (plaster, lime and cement)

Recommended prior knowledge:
Physical and chemical properties of materials. Construction materials,mineral binders
Content of the material:
TP 1.Tests on cements:
Setting test, laser particle size, loss on ignition, insoluble residue, fineness, density
Analysis by fluorescence spectrometry, mineralogical analysis by X-ray diffraction.
Determination of compressive strength
Determination of bending strength

TP 2.Hydraulic lime testing
Determining the start of setting
Determination of volume stability
Determination of compressive strength

TP3. Tests on aerial lime
Determination of calcium and magnesium oxide content
Determination of active lime content
Determination of quicklime reactivity
Determination of grinding fineness

TP 4 Tests on plaster
Determination of pouring and smoothing time
Determination of grinding fineness
Determination of compressive strength
Determination of bending strength
Determination of impurity content

Evaluation method:
Continuous control: 100%; Review: 0%.

Bibliographic references:

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:UED (O/P)
Title of the subject:Stability and reinforcement of the ground
Credits: 2
Coefficients: 2

Teaching objectives:
methods of analyzing the stability of slopes and the sizing of retaining structures, as well as soil reinforcement techniques.

Recommended prior knowledge:
Geology, soil mechanics

Content of the material:
Chapter 1 Stability of slopes and embankments;
Chapter 2 Retaining structures;
Chapter 3 Soil reinforcement;

Evaluation method:
Continuous monitoring: 40%; Review: 60%.

References :
Problem solving in soil mechanics Author: Ali Aysen
Advanced soil mechanics Author: Braja M. Das
Smith's elements of soil mechanics Author Ian Smith
Soil mechanics and geotechnical engineering Author: Arvind V. Shroff, Dhananjay L. Shah
Fundamentals of geotechnical engineering
Author Braja M. Das

Title of the Master: Calculation and Technical Control of Constructions
Semester: 1
EU Title:UET (O/P)
Title of the subject:Technical English and terminology
Credits: 1
Coefficients: 1

Teaching objectives:

Introduce the student to technical vocabulary. Strengthen your knowledge of the language. Help him understand and synthesize a technical document. Allow him to understand a conversation in English held in a scientific framework.

Recommended prior knowledge:

Basic English vocabulary and grammar

Material content:

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

- Oral comprehension: From authentic popular science video documents, note taking, summary and presentation of the document.

- Oral expression: Presentation of a scientific or technical subject, development and exchange of oral messages (ideas and data), Telephone communication, Gestural expression.

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

Recommendation: It is strongly recommended that the subject manager present and explain at the end of each session (at most) around ten technical words from the specialty in the three languages (if possible) English, French and Arabic.

Evaluation method:

Review: 100%.

Bibliographic references:

1. PT Danison, Practical guide to writing in English: uses and rules, practical advice, Editions d'Organization 2007
2. A.Chamberlain, R. Steele, Practical guide to communication: English, Didier 1992
3. R. Ernst, Dictionary of applied techniques and sciences: French-English, Dunod 2002.
4. J. Comfort, S. Hick, and A. Savage, Basic Technical English, Oxford University Press, 1980
5. EH Glendinning and N. Glendinning, Oxford English for Electrical and Mechanical Engineering, Oxford University Press 1995
6. TN Huckin, and AL 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

Title of the Master: Calculation and Technical Control of Constructions
Semester: 2
EU Title:UEF (O/P)
Title of the subject:Reinforced concrete structures 2
Credits: 6
Coefficients: 3

Teaching objectives:
The program for the reinforced concrete structure material (2) completes the same material from 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

Content of the material:

Chapter 1 : Bracing systems

Choice and general bracing of buildings by: porticos, rigid sections, triangulated, concrete sail, stability core and mixed solutions. Location and twisting of sails in structures. Principles of seismic design of buildings

Chapter 2 : Sails

Types, Characteristics and Strength of sails
Reinforcements for trumeaux and lintels

Chapter 3: Deep foundations

Footing on a pile, and several piles;General rafts

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Guerrin and RC Lavaur, “Reinforced concrete treaty; Frames of buildings and factories, floors, stairs, corbels, various building works, Volume 4", Dunod, 1971.
2. Jean Pierre Mougin, “Reinforced concrete, BAEL 91 modified 99 and associated DTU”, Eyrolles, 2000.
3. BAEL 91 rules, “Technical rules for the design and calculation of reinforced concrete works and constructions using the limit states method”, Eyrolles, March 1992.
4. Georges Dreux, “Practical calculation of reinforced concrete. BAEL Rules 83”, 1983
5. Christian Albouy, “Eurocode 2: reinforced concrete - simple elements”, CERPET – STI, 2007.
6. JA Calgaro, “Applications of Eurocode 2 – Design of concrete buildings”, bridges and roads, 2007.
7. A.CHANTI, Bracing of buildings with sails. OPU
8. ALBIGES (M.) and GOULET (J.). – Bracing of buildings. Ann. ITBTP, May 1960.
9. GRINDA (L.). – Calculation of bracing sails for multi-storey buildings. Ann. ITBTP, 1967.
10. Coin A., Decauchy A. and Collignon JP, Shear walls with multiple openings. Year. ITBTP, 71.
11. Henry Thonier, Design and calculation of reinforced concrete structures. Press of the National School of Bridges and Roads, volumes 2, 3 and 4. Edition Eyrolles.

Title of the Master: Calculation and Technical Control of Constructions
Semester: 2
EU Title:UEF (O/P)
Title of the subject:Seismic design and analysis
Credits: 6
Coefficients: 3

Teaching objectives:
This module provides students with the necessary foundations to design structures located in seismic zones and to understand their behavior with respect to earthquakes.

Recommended prior knowledge:

Dynamics of structures and reinforced concrete.

Content of the material:
Chapter 1: Cause of earthquakes and tectonic theory of terrestrial plates.
Chapter 2: Ductility concept.
Chapter 3: Modeling of structures for dynamic analysis.
Chapter 4: Principles and requirements of seismic regulations: method of static equivalent loads,…
Chapter 5: Modal analysis. Dynamic method.
Chapter 6: Seismic design of reinforced concrete structures.
Chapter 7: Seismic evaluation and rehabilitation of structures.

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

References :
Earthquake Engineering: Design and sizing of buildings
Pierino Lestuzzi, Marc Badoux – 2008
Elements of seismic engineering and structural dynamic calculation
André Filiatrault – 1996
Buildings in seismic zones: design of masonry buildings
Albert Fuentès - 1998

Title of the Master: Calculation and Technical Control of Constructions
Semester: 2
EU Title:UEF (O/P)
Title of the subject:Metallic structures
Credits: 6
Coefficients: 3

Teaching objectives:
At the end of the teaching of this subject, the knowledge acquired must allow the student to correctly dimension the structural elements of a metal frame work.

Recommended prior knowledge:

Strength of materials.

Material content:

Chapter 1 : Design and calculation of beam – column connections
(Beam – welded column assembly, Beam – column assembly by bolted end plate
Chapter 2: Design and calculation of column bases
(Hinged post bases, Recessed post bases)
Chapter 3: Design and calculation of raceways:
(Classification of overhead cranes, Actions on the running beam, Calculation of the running beam, Braking beams, Resistance to buckling by shear, Resistance of webs to transverse loads)
Chapter 4: Mixed floors
(Design and calculation of the composite beam, Calculation of the connection)
Chapter 5: Metal frame structures
(Industrial buildings in metal frame, Buildings, multi-storey in metal frame)
Chapter 6: Methods for analyzing metal frame structures
(Classification of structures, Choice of analysis method, Taking into account imperfections in the calculation of stresses)

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. J. MOREL: Calculation of Metallic Structures according to EUROCODE 3.
2. P. BOURRIER; J. BROZZETTI: Metallic and Mixed Steel–Concrete Construction – Volumes 1 and 2 – EYROLLES.
3. Regulatory Technical Document – DTR – BC 2.44 – Design and Calculation Rules for Steel Structures “CCM97”.
4. Regulatory Technical Document – DTR – BC 2-4.10 – Design and Sizing of Mixed Steel-Concrete Structures.
5. EUROCODE N°3 – Calculation of Steel Structures – Part 1-8: Calculation of assemblies

Title of the Master: Calculation and Technical Control of Constructions
Semester: 2
EU Title:EMU (O/P)
Title of the subject:Finite element method
Credits: 6
Coefficients: 3

Teaching objectives:
The objective of this course is to teach the finite element method as a method for solving problems in Mechanics (Civil Engineering in particular) governed by partial differential differential equations with boundary conditions. The goal is to help the student understand how the method works in order to master its practice in software (Digital Modeling).

Recommended prior knowledge:
Numerical methods; Resistance of Materials; Elasticity.

Material content:
Chapter 1 : Introduction & Objectives
Reminder of the equations of the equilibrium of an elastic solid
Exact Solutions Vs Approximate Resolution
Chapter 2: Elements Finished in One Dimension
- Spring element (Stiffness matrix by direct method, Assembly, boundary conditions, resolution)
- Element Bar and Lattice system (Variational formulation (strong and weak), Type of element (Shape function), Rigid matrix by the virtual work principle, Assembly, transformation matrix boundary conditions, resolution)
- Finite Element Beam and gantry (Variational formulation (strong and weak), Type of element (Shape function), Rigid matrix by minimization of potential energy, Assembly, transformation matrix boundary conditions, resolution)

Chapter 3: Elements Finished in Two and Three Dimensions
- Interpolation and shape functions (Triangular element has 3 nodes; Triangular element has 6 nodes; Quadrangular element has 4 nodes; Tetrahedral solid element has 4 nodes; Rectangular solid element has 8 nodes).
- Construction of the stiffness matrix (Triangular element with 6 nodes; Quadrangular element with 4 nodes; Tetrahedral solid element with 4 nodes)
- Finite Elements of Plate Bending

Chapter 4: Finite Elements in Dynamics
Construction of the finite element in One Dimension
- Generalization for three-dimensional problems.

Evaluation method:
Continuous assessment: 40%. Examination 60%

Bibliographic references:

1. Gouri Dhatt, Gilbert Touzot, Emmanuel Lefrançois “finite element method” hermes science publications-2004.
2. Olek C Zienkiewicz,Robert L Taylor,JZ 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 on resistance of materials, elasticity-plasticity, finite elements. ISBN-10: 2729879315 Ellipses, 2000.

Title of the Master: Calculation and Technical Control of Constructions
Semester: 2
EU Title:EMU (O/P)
Title of the subject:Experimental methods
Credits: 3
Coefficients: 2

Teaching objectives: Non-destructive testing (END) represents recognition methods commonly applied to building structures, works of art or civil engineering.

Recommended prior knowledge

Building materials, reinforced concrete elements, metal constructions

Content of the material:
Chapter 1 Inspection of civil engineering constructions
Chapter 2 Non-destructive testing of concrete
Chapter 3 Assessment of the state of degradation of materials

Evaluation method:
Continuous assessment: 40%. Examination 60%

Bibliographic references:

Title of the Master: Calculation and Technical Control of Constructions

Semester: 2
EU Title:UED (O/P)
Title of the subject:Superficial and deep foundations
Credits: 2
Coefficients: 2

Teaching objectives: Study of superficial and deep foundations at failure and evaluation of settlement.

Recommended prior knowledge

Soil mechanics, reinforced concrete.

Content of the material:

Chapter 1: Superficial foundations.

- Modes of failure, Theory of bearing capacity and calculation of bearing capacity for
- different types of superficial foundations and different types of loading,
- Calculation of allowable stress, Calculation of settlements

Chapter 2: Deep foundations.

- Types of deep foundations, Execution methods and Methods for calculating the carrying load of an isolated pile and a group of piles (Static method, Driving formula,
- Penetrometer and pressuremeter tests),
- Positive and negative lateral friction, Calculation of allowable stress, Deep foundation project

Chapter 3: Settlement

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. G. Philipponnat and B. Hubert, Foundations and earthworks, Ed. Eyrolles, 1997
2. G. Frank, Calculation of superficial and deep foundations, Presses des ponts, 1999
3. J. Costet and G. Sanglerat, Practical course in soil mechanics (Volume 2) Ed. Dunod 1983
4. G. Sanglerat, G. Olivari and B. Cambou, Practical problems in soil mechanics and foundations (Volume 2) Ed. Dunod1983

Title of the Master: Calculation and Technical Control of Constructions
Semester: 2
EU Title:UET (O/P)
Title of the subject: Technical Control of Constructions
Credits: 1
Coefficients: 1

Teaching objectives: The objective of technical control of works is to show the methods of verification and control of structures, as well as defects due to the quality of concrete which depends on manufacturing and implementation factors.

Recommended prior knowledge:

Construction materials, reinforced concrete, Strength of materials

Content of the material:

Chapter 1: Assessment of the quality of materials
Chapter 2: Manufacturing control
Chapter 3: Implementation control.
Chapter 4: Inspection of reinforced concrete structures
Chapter 5: Inspections of metal structures

Evaluation method:
Review: 100%.

References :
1- Design and Control of Concrete, author: KOSMATKA Steven
2-Reinforced concrete: Mechanics & design (5th Ed.), author: WIGHT James
3-Design of reinforced concrete structures, author: Gambhir
4-Limit state design of reinforced concrete, author: BC Punmia, Arun Kumar Jain, Arun Kr. Jain

Title of the Master: Calculation and Technical Control of Constructions
Semester: 3
EU Title:UEF (O/P)
Title of the subject:Reinforced concrete structures
Credits: 6
Coefficients: 3

Teaching objectives:
This course covers practical methods for sizing and calculating reinforced concrete structures: retaining walls, tanks, silos and domes, distinguishing between the two stages of calculation of structures: design and execution calculation.

Recommended prior knowledge:
Resistance of materials, Reinforced Concrete.

Material content:

Chapter 1 : Retaining walls

Chapter 2 : Domes

Chapter 3: Silos

Chapter 4: Reservoirs and Water Tower

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Reinforced concrete according to Eurocodes 2 (Dunod 2010)
2. Calculation of reinforced concrete structures (Eyrolles 2013)
3. Sizing of concrete structures according to Eurocode 2 (Le monitreur 2010)
4. Reinforced concrete structures (Eyrolles 2011).

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Title of the Master: Calculation and Technical Control of Constructions

Semester: 3
EU Title:UEF (O/P)
Title of the subject:Prestressed concrete
Credits: 6
Coefficients: 3

Teaching objectives:
Calculation of beams prestressed in bending at the ELU, at the ELS, their justification with regard to torsion, the calculation of particular sections as well as hyperstatic systems.

Recommended prior knowledge
Resistance of materials, Elasticity and reinforced concrete structures.

Content of the material:
Chapter 1 General principles of prestressing.
Chapter 2 Prestressing processes for concrete structures.
Chapter 3 Calculation of the forces equivalent to a given prestressing system.
Chapter 4 Calculation of the effects of shrinkage and creep.
Chapter5 Calculation of the ultimate resistance in bending and shearing of prestressed concrete beams.

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Practical course in prestressed concrete by G.DREUX.
2. Construction in prestressed concrete by Y.GUYON.
3. Prestressed concrete at limit state by H.THONIER.
4. Prestressed concrete course by J.FAUCHET.

Prestressing by Albert CHAUSSIN and R. LA CROIX

Title of the Master: Calculation and Technical Control of Constructions

Semester: 3
EU Title:UEF (O/P)
Title of the subject:Structures with metal frames and mixed structures
Credits: 6
Coefficients: 3

Teaching objectives:This course covers practical methods for sizing and calculating metal and composite structures, distinguishing between the two stages of calculation of structures: design and execution calculation).

Recommended prior knowledge

Resistance of materials, metal constructions, reinforced concrete

Content of the material:
Chapter 1: Main supporting systems of Halles buildings;
Chapter 2: Secondary frameworks – Roofs and facades;
Chapter 3: Supporting systems for multi-storey buildings;
Chapter 4: Mixed works;
Chapter 5: Reticulated space roofs;
Chapter 6: Structures in arches and domes;

Evaluation method:
Continuous monitoring: 40%; Exam: 60%.

References :

1-Metal and mixed steel-concrete construction Volume 1: calculation and sizing according to Eurocodes 3 and 4. author: BOURRIER.

2-Metal and mixed steel-concrete construction Volume 2: design and implementation, author: BOURRIER.

Title of the Master: Calculation and Technical Control of Constructions
Semester: 3
EU Title:EMU (O/P)
Title of the subject:Reinforced concrete structures project
Credits: 6
Coefficients: 3

Teaching objectives:

The objective of this subject is to develop all the stages of a project for structural calculation under the supervision of the teacher responsible for the subject.
Application of knowledge in a design office situation

Recommended prior knowledge:

Resistance of Materials – structural mechanics – Plastic analysis of Structures – MEF – Reinforced concrete – Elasticity – structural modeling.

Material content:

-Presentation and description of the project
-Presentation of the different stages of calculating a project
-Calculation assumptions
-Used materials
-Standards and regulations used
-Choice of the supporting system (mixed structures: sails + porticos)
-Pre-sizing of structural elements and evaluation of loads
-Sizing of floors
-Calculation of secondary elements (a balcony, parapet)
-Seismic study
-Study of structures in relation to the wind
-Calculation and reinforcement of stairs
-Calculation and reinforcement of the supporting structure
-Sizing of foundations.
-Production of plans (formwork plan, reinforcement plan, etc.) for the calculated elements.
Conclusions and perspectives

Evaluation method:

Continuous Control: 40%; Exam: 60%

Bibliographic 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
'Reinforced Concrete Treaty'; by R LACROIX, A.FUENTES and H THONIER; Editions Eyrolles, Paris.
'Practice of BAEL'; J.PERCHAT and J.ROUX; Editions Eyrolles, Paris.
Reinforced concrete calculation of frames; Albert fuentes; Editions Eyrolles, Paris.

Title of the Master: Calculation and Technical Control of Constructions
Semester: 3
EU Title:EMU (O/P)
Title of the subject:TP Modeling and Analysis of structures
Credits: 3
Coefficients: 2

Teaching objectives: This module allows you to summarize the modules linked to structures; it allows you to approach the calculation of a simple structure in a design office approach using computer tools.

Prior knowledge:reinforced concrete, structural dynamics, calculation of structures, resistance of materials, foundations.

Material content:

Chapter 1. Presentation of civil engineering software

Chapter 2. Steps in modeling a structure using the software;

Chapter 3. Modeling of a reinforced concrete structure (residential building or administrative);

Chapter 4. Modeling of a metal frame structure (industrial hangar).

Evaluation method:
Continuous Control: 100%

Bibliographic references:
1 Calculation software: (Robot, STAADIII, SAP2000).
2-Regulatory technical document (DTR BC 2.2). Permanent loads and operating loads.
3-Algerian seismic rules RPA 99 version 2003. DTR –BC-2.48.
4-Snow and wind regulations RNV 1999. DTR-C-2-4.7.
5-Software user manual.

Title of the Master: Calculation and Technical Control of Constructions

Semester: 3
EU Title:UED (O/P)
Title of the subject:Repair and rehabilitation of structures
Credits: 2
Coefficients: 2

Teaching objectives: Know the repair techniques and products available on the market. make the wise choice of an effective and sustainable solution.

Recommended prior knowledge
Reinforced concrete structures, construction materials

Content of the material:
Chapter 1: Durability of concrete
Chapter 2: Diagnosis of reinforced concrete structures
Chapter 3: Exterior protections and surface repairs
Chapter 4: Concrete reconstitution
Chapter 5: Sprayed concrete repair and injection treatment
Chapter 6: Reinforcement by additional prestressing
Chapter 8: Reinforcement and maintenance of structures
Internship which examines a real state of degradation of the structures

Evaluation method:
Exam :100%

References :
ACI 201.2R-92, "Guide to durable concrete," ACI Manual of concrete practice, Part 1: Materials and General properties of concrete, Detroit, Michigan, 1994.

BARON J. & OLLIVIER JP, "The durability of concrete", Presses de l'école nationale des ponts et haussées, France, 1996.

BARON J. & OLLIVIER JP, "LES CONCRETES. Basis and data for their formulation", Eyrolles edition, 1997.
CALGARO JA & LACROIX R., "Maintenance and repair of bridges", Presses de l'école nationale des ponts et haussées, France, 1997.

Title of the Master: Calculation and Technical Control of Constructions
Semester: 3
EU Title:UED (O/P)
Title of the subject:Project planning and management
Credits: 1
Coefficients: 1

Teaching objectives: The objective of this module is to understand the administrative and technical requirements of a project. The planning of the work and the different tasks with the aim of optimizing the resources allocated and having an overall vision of the tasks to be carried out .

Recommended prior knowledge:

Organization of the site

Content of the material:
- Introduction to planning.
- Project management.
- Introduction to project planning.
- Classification of projects.
- Management control.

References :
Site management-**Author(s):BernardLehembre**
-Editor:Nathan
-Project Management: Planning ConstructionAlexandre Faulx-Briole