INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Civil Engineering and Urban Planning

Domaine Scientifique de la DOUA - Bât. A. de Saint-Exupéry
27, avenue Jean Capelle - 69621 VILLEURBANNE

ANNEE : 3ème année / 3rd year - 60 ECTS

SEMESTRE : 1er semestre / 1st semester - 30 ECTS

PARCOURS : Parcours standard / Standard track - 30 ECTS

UE : Identification et Reconnaissance des Sols et des roches / Identification of soils and rocks - 3 ECTS

EC : Géologie de l'Ingénieur / Geology of the Engineer - 1 ECTS

EC : Introduction à la Mécanique des sols et des roches / Introduction to Soil and Rock Mechanics - 2 ECTS

UE : Physique du bâtiment - 1 / Buildings physics - 1 - 4 ECTS

EC : Transferts de chaleur / Heat and Mass Transfers - 2 ECTS

EC : Thermique du bâtiment / Thermo-aerodynamics Behavior of Buildings - 2 ECTS

UE : Matériaux et structures - 1 / Materials and Structures - 1 - 7 ECTS

EC : Initiation à l'analyse des structures - 1 / Initiation to Structural Analysis - 1 - 2 ECTS

EC : Initiation à l'analyse des structures - 2 / Initiation to Structural Analysis - 2 - 1 ECTS

EC : Matériaux / Materials - 2 ECTS

EC : Mécanique des milieux continus solides / Continuum Solid Mechanics - 2 ECTS

UE : Outils de l'ingénieur - 1 / Tools for engineers - 1 - 6 ECTS

EC : Analyse de données / Data Analysis - 2 ECTS

EC : Outils numériques / Numerical Tools - 2 ECTS

EC : Mathématiques générales / Mathematics - 2 ECTS

EC : Fresque de la construction / Construction fresco - ECTS

UE : Etudes urbaines et ateliers / Urban studies - 5 ECTS

EC : Urbanisme / Town Planning - 2 ECTS

EC : Ateliers / Workshop - Teamwork - 3 ECTS

SEMESTRE : 2ème semestre / 2nd semester - 30 ECTS

PARCOURS : Parcours standard / Standard track - 30 ECTS

UE : Mécanique des Fluides / Fluids mechanics - 2 ECTS

EC : Mécanique des fluides / Fluid Mechanics - 2.00 ECTS

UE : Physique du bâtiment - 2 / Buildings physics - 2 - 5 ECTS

EC : Projet conception et TP / Air conditioning and acoustic design of a building - undefined ECTS

EC : Acoustique / Building Acoustics - 1.5 ECTS

EC : Climatisation / Air conditioning - 1.50 ECTS

UE : Mécanique des sols / Soils mechanics - 4 ECTS

EC : Mécanique des sols - 4.00 ECTS

UE : Structures - 2 / Structures - 2 - 10 ECTS

EC : Projet de modélisation de structures / Structural design and Modelling Project - 2.00 ECTS

EC : Méthodes analytiques pour les structures hyperstatiques / Structural Analysis Methods 1: Analytical Methods - 2.00 ECTS

EC : Méthode d'analyse des structures par éléments finis / Structural Analysis Methods 2: Finite Elements Method - 2.00 ECTS

EC : Procédés généraux de construction / Contruction Processes - 1.00 ECTS

EC : Béton armé / Reinforced Concrete Structures - 3.00 ECTS

UE : Outils de l'ingénieur - 2 / Tools for engineers - 2 - 4 ECTS

EC : DAO-SIG / CAD-GIS - 1.00 ECTS

EC : Aide à la décision - 1 / Decision support - 1 - 2 ECTS

EC : Topographie / Surveying - 1.00 ECTS

UE : Stage découverte / Discovery internship - 0 ECTS

EC : Stage découverte / Discovery internship - 0.00 ECTS

ANNEE : 4ème année / 4th year - 60 ECTS

SEMESTRE : 1er semestre / 1st semester - 30 ECTS

PARCOURS : Parcours standard / Standard track - 30 ECTS

UE : Interaction sol-structures / Soil-structures interaction - 3 ECTS

EC : Géotechnique 3 / Geotechnics 3 - 3 ECTS

UE : Structures - 3 / Structures - 3 - 7 ECTS

EC : Multi-Matériaux, Constructions et Systèmes Constructif Innovants / Multi-Materials, Constructions and Innovative Building Systems - 1.00 ECTS

EC : Etudes avancées des structures - 1 / Advanced Structural Analysis - 1 - 1.00 ECTS

EC : Béton précontraint / Prestressed Concrete Structures - 2.00 ECTS

EC : Etudes avancées des structures - 2 / Advanced Structural Analysis - 2 - 1.00 ECTS

EC : Construction métallique / Steel Structures - 2.00 ECTS

UE : Hydraulique et hydrologie / Hydro - 4 ECTS

EC : Hydrologie / Urban Water Management - 1.50 ECTS

EC : Hydraulique générale / Hydraulics - 2.50 ECTS

UE : Etudes urbaines et ateliers / Urban studies - 5 ECTS

EC : Urbanisme / Urban Planning - 2.00 ECTS

EC : Ateliers / Workshop - Teamwork - 3.00 ECTS

UE : Science des données / Data sciences - 6 ECTS

EC : Introduction à la Science des Données / Introduction to Data Science - 2.0 ECTS

EC : Analyse du cycle de vie / Life cycle analysis - 2.00 ECTS

EC : AD2 - Aide à la décision - 2 / Decision Support - 2 - 2.00 ECTS

SEMESTRE : 2ème semestre / 2nd semester - 30 ECTS

PARCOURS : Parcours standard / Standard track - 30 ECTS

UE : Monde économique et professionnel / Economic and professional world - 4 ECTS

EC : Gestion de projets / Project management - 1.00 ECTS

EC : Economie de la construction et ordonnancement / Construction economy and scheduling - 1 ECTS

EC : Sécurité-Certification-Qualité-BIM / Safety-Certification-Quality-BIM - 1.00 ECTS

EC : Droit de la construction / Building law - 1.00 ECTS

UE : Stage découverte / discovery internship - 0 ECTS

EC : Stage découverte / discovery internship - 0.00 ECTS

UE : Modules optionnels / Optionnal courses - 20 ECTS

EC : Building design: multidisciplinary approach - 5.00 ECTS

EC : Diagnostic et réparation des structures - 5.00 ECTS

EC : OGC, Ouvrages Géotechniques face au Changement Climatique / Geotechnical Structures for Climate Change - 5.00 ECTS

EC : Energy management in Buildings - 5.00 ECTS

EC : Matériaux Innovants pour la Construction Durable - 5.00 ECTS

EC : Projets urbains - 5.00 ECTS

EC : BIM : Outils et méthodes de travail - 5.00 ECTS

EC : MEG, Modeling Environmental Geostructures - 5.00 ECTS

EC : Adapting cities for climate change: Understanding to enable sustainable designs - 5.00 ECTS

EC : Villes et techniques : écotechnologies et transitions urbaines - 5.00 ECTS

EC : Structures biosourcés - 5.00 ECTS

EC : Matériaux : Expérimentation et Modélisation - 5.00 ECTS

EC : Vulnérabilité des ouvrages dans leur environnement : Modélisations avancées des structures - 5.00 ECTS

EC : IAPPI (Ingénierie-Architecture. Pratiques et Processus de l'Innovation - 5.00 ECTS

EC : Urbanisme et aménagement durable des territoires - 5.00 ECTS

EC : Integrated urban water management - 5.00 ECTS

ANNEE : 5ème année / 5th year - 60 ECTS

SEMESTRE : 1er semestre / 1st semester - 30 ECTS

PARCOURS : Parcours standard / Standard track - 30 ECTS

UE : Projet d'Initiation à la Recherche et Développement / R&D Training project - 12 ECTS

EC : Projet d'Initiation à la Recherche et Développement / R&D initiation project - 12.00 ECTS

UE : Biodiversité / Biodiversity - 1 ECTS

EC : Biodiversité / Biodiversity - 1.00 ECTS

UE : Réglementation Environnemental 2020 / 2020 Environmental Regulations - 2 ECTS

EC : Réglementation Environnemental 2020 / 2020 Environmental Regulations - 1.00 ECTS

EC : Pathologie / Pathology - 1.00 ECTS

UE : Projet métier / Project - 12 ECTS

EC : Projet métier Aménagement Urbain / Urban Planning - 12.00 ECTS

EC : Projet métier Infrastructures et Ouvrages d'Art / - in bridge and infrastructure design - 12.00 ECTS

EC : Projet Métier Bâtiment Environnement Confort / - in building design - 12.00 ECTS

UE : Sciences Humaines pour Ingénieurs en Formation à la Transition / Human sciences for engineers : the transition - 2 ECTS

EC : Sciences Humaines pour Ingénieurs en Formation à la Transition / Human sciences for engineers : the transition - 2.00 ECTS

SEMESTRE : 2ème semestre / 2nd semester - 30 ECTS

PARCOURS : Parcours standard / Standard track - 30 ECTS

UE : Stage en situation d'ingénieur / Internship as an engineer - 30 ECTS

EC : Stage Ingénieur - 30 ECTS

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Geology of the Engineer

IDENTIFICATION

CODE : GCU-3-S1-EC-GEOL
ECTS : 1

HOURS

Cours :	6h
TD :	0h
TP :	4h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	11.5h
Travail personnel :	7h
Total :	18.5h

ASSESMENT METHOD

Written exam : 1h

TEACHING AIDS

Copy of the course

TEACHING LANGUAGE

French

CONTACT

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MME POTHIER Catherine :
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AIMS

Be able to:
- Identify, characterize and classify different soils
- Perform and interpret basic tests for soil characterization
- Identify groundwater and soil hydraulic properties, modeling flow in soils
- Interact with specialists

objectives
Acquire detailed knowledge of the nature of soil and flow in soils

Make and interpret a geological section, interpret a map, identify a geological horizon (level 2);

CONTENT

- Introduction "Geology and Civil Engineering
- description of the structure of the earth
- Petrography: analysis of the 3 main families of rocks
- Basic knowledge of stratigraphy and tectonics
- Cartography

BIBLIOGRAPHY

- Parriaux A. (2006) Géologie, bases pour l'ingénieur, Presses Polytechniques Romandes, Lausanne

PRE-REQUISITES

Bac + 2 level

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20 Avenue Albert Einstein - 69100 VILLEURBANNE

Introduction to Soil and Rock Mechanics

IDENTIFICATION

CODE : GCU-3-S1-EC-IMRS
ECTS : 2

HOURS

Cours :	8h
TD :	12h
TP :	12h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	33h
Travail personnel :	20h
Total :	53h

ASSESMENT METHOD

Written exam : 2h
Intermediate assessments : 3*0,5h
Oral presentation of laboratory work : 1h

TEACHING AIDS

Copy of the course
Copy of the laboratory work

TEACHING LANGUAGE

French

CONTACT

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AIMS

Be able to:
- Identify, characterize and classify different soils
- Perform and interpret basic tests for soil characterization
- Identify groundwater and soil hydraulic properties, modeling flow in soils
- Interact with specialists

objectives
Acquire detailed knowledge of the nature of soil and flow in soils

Make and interpret a geological section, interpret a map, identify a geological horizon (level 2);

CONTENT

- Presentation of the geotechnics field.
- The physical properties of soils, dimensional parameters, dimensionless parameters, relationship between parameters
- Constitutive elements, soil physical characteristics and structure of the solid particles
- The clays
-I dentification tests for soil classification
- The geotechnical soil classifications
-The flow of water in soils, Darcy's law and the permeability of the soil, networks of flows, flow forces, water tests in the laboratory and in situ, flow in unsaturated soils.

and
- Introduction "Geology and Civil Engineering
- description of the structure of the earth
- Petrography: analysis of the 3 main families of rocks
- Basic knowledge of stratigraphy and tectonics
- Cartography

BIBLIOGRAPHY

- Afnor standards
- Cassan (1994), Aide-mémoire d'hydraulique souterraine, Presses de l'Ecole Nationale des Ponts et Chaussées, Paris.
- Cordary D. (1994) Mécanique des sols, Lavoisier - Tec & Doc
- Holtz R.D., Kovacs W.D., (traduit par Lafleur J.) (2006) Introduction à la géotechnique, Editions de l'Ecole Polytechnique Montréal
- Parriaux A. (2006) Géologie, bases pour l'ingénieur, Presses Polytechniques Romandes, Lausanne
- Philipponnat G, Hubert B (2008) Fondations et ouvrages en terre, Eyrolles, 7ème édition.
- Schlosser F. (2003) Eléments de mécanique des sols, Presses de l'Ecole Nationale des Ponts et Chaussées, Paris

PRE-REQUISITES

Bac + 2 level

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Heat and Mass Transfers

IDENTIFICATION

CODE : GCU-3-S1-EC-TC
ECTS : 2

HOURS

Cours :	10h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	20h
Total :	49.5h

ASSESMENT METHOD

Written exam

TEACHING AIDS

Written materials of the module (lectures, exercises)

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S1-UE-Ph-Bat-1 Building Physics and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)
A2- Operate a model of a real or virtual system
A4- Design a system that meets specifications
A6- Communicate a scientific analysis or approach

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously
B3- Interact with others, work as a team
B4- Demonstrate creativity, innovate and undertake
B5- Act responsibly in a complex world
B6- Position oneself, work, evolve within a company or a socio-productive organization

Competences specific to the specialty:
C15- Design and control good technical solutions for buildings in terms of thermal, airflow, acoustics
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance

Allowing the student to:
-Understand the heat transfer by conduction, convection and radiation
-Analyse the heat transfer phenomena in buildings
-Solve problems of coupled heat transfer in dynamic conditions
-Master appropriate analytical and numerical methods

CONTENT

- Steady-state and dynamic heat conduction
- Natural and forced convection
- Thermal radiation
- Black and grey body
- Radiation between grey surfaces separated by a transparent environment
- Coupled thermal exchange
- Analytical and numerical solution of coupled heat transfer

BIBLIOGRAPHY

- ASHRAE (2001). Heat transfer. Fundamentals. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta, GA
- Degiovanni, A. (1999). Transmission de l'énergie thermique - Conduction. Technique de l'Ingénieur.
- Incropera, F. et al. (2007). Fundamentals of heat and mass transfer 6th edition. John Wiley & Sons.
- Lefebvre, G. (1994). Comportement thermique dynamique des bâtiments : simulation et analyse. Techniques de l'ingénieur. B2041.
- Jean-Francois Sacadura, coordonnateur (1993). Initiation aux transferts thermiques. Tec & Doc Lavoisier, Paris
- Strang, G. (1986). Introduction to applied mathematics. Welley-Cambridge Press

PRE-REQUISITES

Documentary research (PC-S1-DOC)

Algorithms and computer programming (PC-S1-IF)
Algorithms and computer programming (PC-S2-IF)
Algorithms and computer programming (PC-S3-IF)
Algorithms and computer programming (PC-S4-IF)

Mathematics for applied sciences (PC-S1-OM)
Mathematics for applied sciences (PC-S1-OM-P)

Thermodynamics (PC-S2-TH)

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Thermo-aerodynamics Behavior of Buildings

IDENTIFICATION

CODE : GCU-3-S1-EC-THB
ECTS : 2

HOURS

Cours :	8h
TD :	24h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	34h
Travail personnel :	18h
Total :	52h

ASSESMENT METHOD

- 2 projects + defence of the second project (20% of the evaluation)
- 1 final examination (2h) (80% of the evaluation)

TEACHING AIDS

Course material given during the lessons + Digital documents available

TEACHING LANGUAGE

French

CONTACT

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AIMS

This sheet falls within the Course Unit GCU-3-S1-UE-Ph-Bat -1, "Building Physics - 1" and contributes to:

General Skills in Science for the Engineer:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 2)
A6- Communicate a scientific analysis or approach with adapted situational conditions to the specialty (level 2)

Skills specific to the speciality domain :
C15- Design and control good technical solutions for buildings in terms of thermal, airflow,acoustics (level 2)
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance (level 2)
C25- Contribute to sustainable planning and sustainable construction (level 1)

By mobilizing the following skills :
B3- Interact with others, work as a team
B4- FShow creativity, innovate and undertake

By allowing the student to work and be assessed on the following knowledge:
- basis of heat and mass transfers (convection, conduction, radiative transfers and coupled heat and mass transfers),
- hypotheses for the application of these theoretical bases specific to the field of heat and mass transfers in buildings,
- models for and and mass transfers in buidings,
- numerical representation of these models and methods to solve nonlinear differential equations (space and time)

By allowing the student to work and be assessed on the following abilities:
- knowing the theoretical part of heat transfers and their application to field of heat and mass transfers in building,
- modeling of buildings: decomposition in "thermal zones", walls, materials, coupling between walls, mass transfers,
- implement design methods using simulation tools ,
- analyze simulation results and return results with critical mind,
- propose innovative and sustainable solutions

CONTENT

- Humid air : caractéristics
- Coupled heat and mass transfers in transient conditions
- Assumptions concerning coupled heat and mass transfers in buildings
- Ventilation: principles and technology
- Modeling of mass transfers in buildings "one zone / one mean pressure" model
- Modelling of couple heat and mass transfers in buildings
- numerical representation of equations
- Simulation of buildings: training through the use of a software (CODYBA)

BIBLIOGRAPHY

- Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt, Fundamentals of Heat and Mass Transfer, 7th Edition, ISBN: 978-0-470-50197-9, Apr 2011, 1072 pages

-B. EYGLUMENT Manuel de Thermique. Théorie et pratique. Hermès

-Ian Ashdown, Radiosity, Wiley, 1994

-R.Dehausse, Energétique des bâtiments, Pyc Editions, 1988.

- J.-J. Roux, F. Kuznik (2015), Chapitre : « Modélisation thermique du bâtiment », Energétique des bâtiments et simulation thermique, Eyrolles, ISBN13978-2-212-14275-4

- F. Kuznik, J.-J. Roux, Chapitre : « Les thèmes de recherche en cours et à développer dans le domaine du bâtiment,Transferts thermique couplés à l'échelle du bâtiment », Livre Blanc sur les recherches en énergétique des bâtiments, ISBN 978-2-35671-051-2, Presse des Mines, ISBN : 9782356710512, 2013,

- CODYBA : http://www.jnlog.com/codyba1.htm, consulté le 23/10/2018

PRE-REQUISITES

- Elementary thermodynamics,
- Heat and mass transfers
- Differential equations,
- Basics of numerical analysis: linear and/or non-linear, algebraic and differential

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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20 Avenue Albert Einstein - 69100 VILLEURBANNE

Initiation to Structural Analysis - 1

IDENTIFICATION

CODE : GCU-3-S1-EC-IAS-1
ECTS : 2

HOURS

Cours :	12h
TD :	18h
TP :	4h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	36h
Travail personnel :	20h
Total :	56h

ASSESMENT METHOD

Examen (2h)

TEACHING AIDS

+ MOODLE plateform

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S1-EC-IAS1 and contributes to :

Competences in Engineering Science:
A1 - Analyze a real or virtual system (or problem) (level 1)
A2 - Operate a model of a real or virtual system (level 1)

Competences specific to the specialty :
GCU-C1 : C7 - Building structure (design, sizing) (level 1)
GCU-C2 : C8 - Civil Engineering Structures (design, sizing) (Level 1)

Allows the student to work and be evaluated on the following knowledge:
+ calculation of internal forces within structures
+ calculation of cross-section inertia
+ calculation of normal and tangential stresses

Allows the student to work and be evaluated on the following abilities:
+ Beam theory of Euler-Bernoulli

CONTENT

Lectures
+ Beam theory of Euler-Bernoulli

Tutorials
+ Actions in isostatique structures
+ Internal efforts
+ Cross-section inertia
+ Normal and tangential stresses

Practical work
+ Structural expérimentation
+ Images correlation and strain gages
+ Validation of beam theory hypothesis

BIBLIOGRAPHY

TIMOSHENKO S. Résistance des matériaux (2 vol), 1947-1962

COURBON J. Calcul des structures. DUNOD, 1972

LAROZE S. Résistance des matériaux et structures. EYROLLES, MASSON, 1974

KERGUIGNAS M. Applications de la résistance des matériaux. DUNOD, 1981

PRE-REQUISITES

+ Static mechanics
+ Continuum Mechanics

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Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Initiation to Structural Analysis - 2

IDENTIFICATION

CODE : GCU-3-S1-EC-IAS-2
ECTS : 1

HOURS

Cours :	4h
TD :	8h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	13.5h
Travail personnel :	13h
Total :	26.5h

ASSESMENT METHOD

Written exam

TEACHING AIDS

On line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit : GCU-3-S1-UE-STRUCT-1 and contributes to :

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)
A2- Operate a model of a real or virtual system

Competences specific to the specialty:
C7- Structure bâtiment (concevoir, dimensionner ou contrôler une ¿) ;
C8- Ouvrage d'art (concevoir, dimensionner ou contrôler un ¿) ;

Mobilizes the following competences :
Structural stabilty analysis,
Bars structures methods analysis,
Force and funiculaire polygons.

Allows the student to work and be evaluated on the following abilities:
to define the structural stability,
determine the hyperstatic unknowns number,
understanding mechanical behavior of bars and beams structure.

CONTENT

BIBLIOGRAPHY

TIMOSHENKO S. Strength of materials (2 vol), original edition 1956, reprinted 1976, Robert E. Krieger publishing, Huntington, New-York.
COURBON J. Calcul des structures. DUNOD, 1972.
LAROZE S. Résistance des matériaux et structures. EYROLLES, MASSON, 1974.
KERGUIGNAS M. Applications de la résistance des matériaux. DUNOD, 1981.

PRE-REQUISITES

GCU-31-MMC General notions of rigid solid mechanics
Continuum Solid Mechanics

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Materials

IDENTIFICATION

CODE : GCU-3-S1-EC-MA
ECTS : 2

HOURS

Cours :	14h
TD :	0h
TP :	10h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	25.5h
Travail personnel :	26h
Total :	51.5h

ASSESMENT METHOD

Written exam 3h
Report of practical works

TEACHING AIDS

Duplicated documents
On-line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S1-UE-STRUCT-1 (Materials & Structures - 1) and contributes to:

Competences in Engineering Science:
A3- Implement an experimental approach
A4- Design a system that meets specifications

Competences in Humanities, Documentation and Physical and Sports Education:
B3- Interact with others, work as a team

Competences specific to the specialty:
C7- Building structure (design, dimension and control a...)
C8- Civil Engineering Structures (design, dimension and control a...)
C25- Contribute to sustainable urban developments and sustainable construction

Allows the student to work and be evaluated on the following knowledge:
- Basic science concepts that underlie each property of the materials.
- Properties of cementitious materials, metallic, polymers, composites, natural, and their limits.
- Concrete formulation according to EN 206 standard.
- Influential factors of sustainability within the meaning of the standard.

Allows the student to work and be evaluated on the following abilities:
- Evaluate the relevance of the use of this or that material.
- Know how to choose a material according to the required properties.
- Know how to establish the general composition of a concrete according to the exposure environment from the norm.
- Understand the link between macroscopic properties of a concrete and its microscopic characteristics.
- Write as a team a critical report on the formulation of cementitious materials (SHS-3).

CONTENT

Generally, aims are to :

- Introduce the main materials in the civil engineering practice,
- Deffine the main material properties, througout characterisation,
- Exhibition of relations between structure and material in order to underline benefits from the material science,
- Quality and normalisation,
- Cement, concrete, steel, wood, composite, alternative binder for sustainable construction : fabrication, product type, implementation, practice, properties, durability, activity fields: production/recycling/energy
- Practical works: Raw materials characterization (cements, aggregates, ...), Normalisation, Concretes formulation, Experimental mechanical characteristics identification of concrete, Introduction to different concretes (High-performance, Self-levelling, ...).

BIBLIOGRAPHY

MEHTA et MONTERO. Concrete: Structure, Properties and Materials. Prentice Hall, Ed. - USA - 2°éd, 1993.
DORLOT, BAILON et MASOUNAVE. Des Matériaux. Editions de l'école Polytechnique de Montréal - 2° éd, 1991.
KURTZ, MERCIER et ZAMBELLI. Introduction à la science des matériaux. Presses Polytechniques Romandes. LAUSANNE-2°éd, 1995.
DUPAIN, LANCHON et SAINT-ARROMAN. Granulats, sols, ciments et bétons. Ed Casteilla, Paris, 1995.
ASHBY et JONES, Matériaux, tomes 1 et 2. Dunod, Paris, 1998.

PRE-REQUISITES

Background on solid mechanics and physics.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Continuum Solid Mechanics

IDENTIFICATION

CODE : GCU-3-S1-EC-MMC
ECTS : 2

HOURS

Cours :	10h
TD :	16h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	26h
Total :	54h

ASSESMENT METHOD

Multiple-choice questionnaire
Written exam

TEACHING AIDS

On-line documents

TEACHING LANGUAGE

French

CONTACT

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M. BUI Tan :
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AIMS

To develop skills in the analysis of complex mechanical problems:
- acquisition of a theoretical background on continuum solid mechanics
- initiation to the law behaviour modelling of solid materials

CONTENT

Solid deformation: displacement and strain tensor, properties of the strain tensor, graphical representations, infinitesimal strain tensor, integrable conditions of the strain tensor

Force study: fundamentals of statics ; external forces: volume and surface forces ; internal forces: stress vector, stresses, stress tensor ; properties of the stress tensor ; graphical representations ; equilibrium equations: internally and at the surface of solids

Stress-strain relations: behaviour laws ; experimental views for isotropic and anisotropic materials ; time and temperature influence on law material behaviour

Elasticity: assumptions ; constitutive equations ; Hooke law for isotropic and anisotropic materials

BIBLIOGRAPHY

TIMOSHENKO S., GOODIER J.N. Theory of elasticity, 3d ed., New York, McGraw-Hill, 1970.
BAMBERGER Y. Mécanique de l'ingénieur - milieux déformables. HERMANN, 1984.
MANDEL J. Cours de mécanique des milieux continus GAUTHIERS-VILLARS, 1966.
OBALA J. Exercices et Problèmes de mécanique des milieux continus. MASSON, 1988.
SALENCON J. Mécanique des milieux continus. Cours de l'école polytechnique, 1988.

PRE-REQUISITES

Differential calculus - Integral calculus - Matrix calculus
General background on general solid mechanics without deformation

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Data Analysis

IDENTIFICATION

CODE : GCU-3-S1-EC-AND
ECTS : 2

HOURS

Cours :	10h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	20h
Total :	52h

ASSESMENT METHOD

Final Exam

TEACHING AIDS

Handouts

TEACHING LANGUAGE

French

CONTACT

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AIMS

In GCU, as an originator of work (stopping, bridge, road, viaduct), or developer, the experimental data constitute the fundament of the work of the engineer. At the end of the course of data analysing, the engineers will acquire the tools of statistical analysis as well as their application in the Civil Engineering and Town Planning field. Thus, they will be able to conceive, realise, use and interpret the investigations and the surveys. The probability laws will allow them modelling the observed phenomena.

Getting familiarized with theoretical elements and the basic tools, in order to analyse statistic information .

Competences in Engineering Sciences :
A1 : Analyze a real or virtual system (or problem)
A2 : Operate a model of a real or virtual system
A5 : Process data

Competences in Humanities, Documentation and Physical and Sports Education :
B2 : Work, learn, progress autonomously
B3 : Interact with other, work as a team
B4 : Demonstrate creativity, innovate and undertake

CONTENT

- The theory of probabilities, random variables plain and multidimensional,
- Laws of probabilities, stochastic convergence.
- Investigation technics : sample, random investigations interpretation(problems of estimating, comparing)
- Assumption tests
- statistical data analyse.

BIBLIOGRAPHY

GRAIS, B. 1992, Méthodes statistiques, Dunod, Bordas Paris.
GROSBRAS, J-M. 1987, Méthodes statistiques des sondages. Economica, Paris

PRE-REQUISITES

Scientific Bachelor degree + 2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Numerical Tools

IDENTIFICATION

CODE : GCU-3-S1-EC-ONUM
ECTS : 2

HOURS

Cours :	12h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0.5h
Face à face pédagogique :	32.5h
Travail personnel :	20h
Total :	52.5h

ASSESMENT METHOD

Examination of three reports to be written for each small project (66% of the final grade).
One MCQ on Moodle (34% of the final grade).

TEACHING AIDS

Courses + introduction lecture notes + additional readings.

Training sessions to learn methods and functions with Matlab.

Four small projects for groups of two students aiming to implement with Matlab the various methods and functions applied to practical cases. The small projects will be done partly during the training sessions and partly as home work.

TEACHING LANGUAGE

French

CONTACT

M. JEREMIE BONNEAU : gislain.lipeme-kouyi@insa-lyon.fr

M. BERTRAND-KRAJEWSKI Jean-Luc : jean-luc.bertrand-krajewski@insa-lyon.fr

AIMS

This module is part of the course unit GCU-3-S1-UE-OUTILS-1 (Engineering tools) and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A2- Operate a model of a real or virtual system (level 2)
A5- Process data (level 2)

Mobilizes the following competences:
B2- Work, learn, progress autonomously (level 2)
B3- Interact with others, work as a team (level 2)

Allows the student to work and be evaluated on the following abilities:
- enforce the main basic numerical methods to solve problems with Matlab: a) ordinary differential equation with initial conditions: the Runge-Kutta method, b) finite differences method: ordinary differential equations and elliptic, parabolic and hyperbolic differential equations.

CONTENT

- General introduction to numerical methods in Civil Engineering, demo and first use of Matlab
- Solving first and second order differential equations with initial conditions using the Runge-Kutta method
- Finite differences method (FD): general principles, choice of operators
- Solving differential equations with boundary conditions by FD, boundary conditions on the function or its derivative.
- Classification of partial differential equations (PDEs): elliptic, parabolic, hyperbolic
- FD solution of elliptic PDEs
- FD solution of parabolic PDEs (explicit, implicit and mixed implicit schemes, stability and convergence conditions)
- FD solution of hyperbolic PDEs (implicit mixed scheme)
- FD solution of differential equations with initial conditions (analogy with parabolic and hyperbolic PDEs).

Tutorials: each part of the course is the subject of specific exercises done with Matlab, either by writing specific codes and/or using Matlab functions (for example ode23, ode45, solverPDE...).

BIBLIOGRAPHY

Rappaz J., Picasso M. (1997).
Introduction à l'analyse numérique. Lausanne (Suisse) : Presses polytechniques et universitaires romandes, (diffusion Lavoisier Paris), 255 p. ISBN 288074363X.

Nougier J.-P. (2001).
Méthodes de calcul numérique (tomes 1 et 2). Paris (France) : Hermès, 332 p. et 406 p. ISBN 9782746202788 et 9782746202795.

+ Numerical Recipes on internet

+ Matlab user manuals

PRE-REQUISITES

Baccalauréat + 2 years Scientific Level

Integration, derivation, linear algebra, series development.

Use of Matlab.

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Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mathematics

IDENTIFICATION

CODE : GCU-3-S1-EC-MG
ECTS : 2

HOURS

Cours :	10h
TD :	10h
TP :	6h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	26h
Travail personnel :	24h
Total :	50h

ASSESMENT METHOD

One written exam: 2 hours.

TEACHING AIDS

Magistral course + Exercises (Classwork)

TEACHING LANGUAGE

English

CONTACT

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marco-valerio.dagostino@insa-lyon.fr

AIMS

This module is part of the course unit GCU-3-S1-UE-OUTILS-1 (General Mathematics) and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 1)
A2- Operate a model of a real or virtual system (level 1)
A5- Process data (level 1)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 1)
B4- Demonstrate creativity, innovate and undertake (level 1)

Mobilizes the following competences
- mathematical tools for engineering

Allows the student to work and be evaluated on the following knowledge:
(1) First and second order linear differential equations with constant coefficients; Systems of differential equations with constant coefficients; Examples of differential equations with non-constant coefficients.
(2) Integrals and Laplace Transform.
(3) Pre-Hilbertian Spaces and Fourier Series.
(4) Equations of Mathematical Physics; Method of separation of variables.

Allows the student to work and be evaluated on the following abilities:
- Effective synthesis
- use mathematical models to describe the behaviour of real physical systems

In view of the application to other engineering fields (e.g. Heat Transfer or Structural Mechanics), this course aims to provide some standard mathematical tools by means of both rigorous methods and illustrative examples.

CONTENT

(1) First and second order linear differential equations with constant coefficients; Systems of differential equations with constant coefficients; Examples of differential equations with non-constant coefficients.
(2) Integrals and Laplace Transform.
(3) Pre-Hilbertian Spaces and Fourier Series.
(4) Equations of Mathematical Physics; Method of separation of variables.

BIBLIOGRAPHY

A. N. Tikhonov, A. A. Samarskii: Equations of Mathematical Physics, Dover Publications inc., New York, 1963.

Gilsinger Jean-Marc et Jaï Mohammed : éléments d'analyse fonctionnelle : fondements et applications aux sciences de l'ingénieur. Presses polytechniques et universitaires romandes, 2010.

Murray Spiegel : transformées de Laplace. Cours et problèmes. McGraw-Hill, 1993.

PRE-REQUISITES

Classical undergraduate (bac+2) course of mathematics (INSA 1st cycle or other University)

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Ensemble de cartes illustrées représentant les étapes du cycle de vie d'un bâtiment et leurs impacts environnementaux./A set of illustrated cards representing the stages of a building's life cycle and their environmental impacts.

IDENTIFICATION

CODE : GCU-3-S1-EC-FDLC
ECTS :

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	0h
Total :	0h

ASSESMENT METHOD

TEACHING AIDS

A set of illustrated cards, categorized by theme or by stage of the life cycle (raw materials, manufacturing, transport, implementation, use, end-of-life, impacts, solutions…).
A large sheet or panel (such as paperboard, kraft paper, or canvas) used to stick or arrange the cards.

TEACHING LANGUAGE

French

CONTACT

AIMS

Identify the main stages of a building's life cycle, from material production to end-of-life (demolition, reuse).

Understand the major environmental impacts of the construction sector (greenhouse gas emissions, energy consumption, waste generation, etc.).

Establish connections between technical and architectural choices and their environmental and social consequences.

Encourage collective reflection on possible levers for reducing the environmental footprint of buildings.

Strengthen collaboration and teamwork through a fun and participatory activity.

Initiate an ecological transition approach within construction-related professions.

CONTENT

1 – Introduction
Presentation of the context (climate challenges in the construction sector), the objectives of the activity, and the rules of the workshop.

2 – Construction phase
Group work using cards: participants reconstruct the life cycle stages of a building and identify their environmental impacts.

3 – Break / Breathing time
A moment to pause or reflect, depending on the group's pace.

4 – Group debrief
Discussion around the completed fresk: feedback on impactful cards and dialogue on cause-and-effect relationships.

5 – Reflection on levers for action
Group identification of possible actions (in design, construction, use, and end-of-life).

6 – Conclusion
Synthesis of key learnings and opening towards next steps (training, projects, personal or professional engagement).

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Town Planning

IDENTIFICATION

CODE : GCU-3-S1-EC-UR
ECTS : 2

HOURS

Cours :	12h
TD :	4h
TP :	0h
Projet :	0h
Evaluation :	0.5h
Face à face pédagogique :	16.5h
Travail personnel :	30h
Total :	46.5h

ASSESMENT METHOD

Individual examination and group project

TEACHING AIDS

slides

TEACHING LANGUAGE

French

CONTACT

M. DELEUIL Jean-Michel :
jean-michel.deleuil@insa-lyon.fr

AIMS

This EC falls under the Teaching Unit: GCU-3-S1-UE-ET-URB-1 (urban studies and workshops) and
contributes to:

School competencies in humanities:
B5-Act responsibly in a complex world (level 1);

Specialty-specific school skills:
C20-Analyze an urban situation (technical, political, social, at all scales) (level 1);

By allowing the student to work and be assessed on the following abilities:
- carry out a mini urban planning project, establish a development plan, produce a plan of intent, an urban composition plan and summarily cost a program

By allowing the student to work and be assessed on the following knowledge:
- basic principles and vocabularies of town planning.

CONTENT

- basic town planning principles
- spatial planification methods and tools
- urban framework
- urban morphology
- urban theories

BIBLIOGRAPHY

- J. Pelletier, Ch. Delfante, 1994, Villes et urbanisme dans le monde, éd. Masson, Paris.
- M. Ragon, Histoire mondiale de l'architecture et de l'urbanisme, Casterman, Paris, 1986

PRE-REQUISITES

Students will be expected to write and express themselves in good grammatical and Standard French.

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Domaine Scientifique de la DOUA
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IDENTIFICATION

CODE : GCU-3-S1-EC-AT
ECTS : 3

HOURS

Cours :	4h
TD :	13h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	17h
Travail personnel :	42h
Total :	59h

ASSESMENT METHOD

- 1 report (15 pages)
- 1 oral presentation (15 mn)

TEACHING AIDS

Digital documents available.

TEACHING LANGUAGE

French

CONTACT

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Mme BERDIER Chantal :
chantal.berdier@insa-lyon.fr
Mme LARRAUFFIE Elodie :
elodie.prudhomme@insa-lyon.fr

AIMS

This module is part of the course unit GCU-3-S1-UE-ET-URB-1 (études urbaines et ateliers) and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 3);
B3- Interact with others, work as a team (level 3);
B5- Act responsibly in a complex world (level 1);
B6- Position oneself, work, evolve within a company or a socio-productive organization (level 1);

Competences specific to the specialty:
C20- Analyse an urban context (technical, political and social patterns at different scales) (level 2) ;
C23- Contribute to a pluri-disciplinary design process of buildings (level 1) ;
C25- Contribute to sustainable urban developments and sustainable construction (level 1) ;

Mobilizes the following competences:
B4- Demonstrate creativity, innovate and undertake.

Allows the student to work and be evaluated on the following knowledge:
- stakeholders, roles, procedures, standards of civil engineering and urban planning;
- urban history of Lyon and its agglomeration.

Allows the student to work and be evaluated on the following abilities:
- analyze an urban realization and a productive process with a relevant analysis grid (heritage & re-use, prototype and innovation, ...);
- work autonomously;
- work as a team, even provide leadership;
- carry out and use a literature review;
- communicate its results with rigor, verbally and through a report.

CONTENT

The work is done by a team of 3 students.
Each team choose a real object (building, public equipment, urban space, etc.) situated in the Greater Lyon.

Students are asked to analyse this "object" by using concepts proposed by the teaching team, for instance: "heritage & re-use", "sustainable construction", "prototype & innovation".

BIBLIOGRAPHY

- Boudia D., Nadji F. (2018). Plagiat, citation et références bibliographiques [en ligne]. Villeurbanne : INSA Lyon, 2018. Disponible sur : http://referencesbibliographiques.insa-lyon.fr/ (Consulté le 03/09/2018)
- Choay F. (1999). L'allégorie du patrimoine. Paris : Seuil.
- Delfante C. et Pelletier, J. (2006). Plans de Lyon : Portraits d'une ville 1350-2015. Lyon : Éditions Stéphane Bachès.
- Pelletier, J. et Delfante C. (2004). Atlas historique du Grand Lyon. Formes urbaines et paysages au fil du temps. Lyon : Éditions Xavier Lejeune - Libris.
- Ouvrage collectif (2011) Grand Lyon Architectures Contemporaines, 1906 - 2011. Paris : Archibooks.
- Riegl A. (2003) Le culte moderne des monuments. Sa nature, son origine. Traduit et présenté par J. Boulet. Paris : L'Harmattan.

PRE-REQUISITES

Students are expected to write and express themselves in good grammatical and standard French so that they can discuss with contact people and contribute to the report.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid Mechanics

IDENTIFICATION

CODE : GCU-3-S2-EC-MF
ECTS : 2.00

HOURS

Cours :	12h
TD :	18h
TP :	6h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	38h
Travail personnel :	26h
Total :	64h

ASSESMENT METHOD

Lab report
Written final Exam (2h)

TEACHING AIDS

Course document/slides
Copy of the laboratory work, Course files on network

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S2-EC-MF and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (Level 2)
A2- Operate a model of a real or virtual system (Level 2)
A3- Implement an experimental approach (Level 1)
A4- Design a system that meets specification (Level 2)
A5- Process data (Level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B1- Know oneself; manage mental and physical fitness (Level 2)
B2- Work, learn, progress autonomously (Level 2)
B3- Interact with others, work as a team (Level 2)

Competences specific to the specialty:
C17- Designing and sizing networks and structures based on hydrologic and hydraulic approaches for urban planning, buildings and civil engineering infrastructures (Level 2)

Allows the student to work and be evaluated on the following knowledge:
- Physical properties of fluids
- hydrostatics
- kinematics
- hydrodynamics: balance equations (mass and momentum)
- aeraulics

Allows the student to work and be evaluated on the following abilities:
- characterize the type of a gravitational flow regime, calculate dynamic and static fluid strength on structures, apply theoretical models to describe and design hydraulic network with pressurized flows (laminar and turbulent)
- analyze physical phenomena, master the characteristic variables, the units and be able to know numerical range of physical data involved in a flow in order to discuss with a specialisGCU-S6-MF

CONTENT

- Chapter 1: physical properties of fluids
- Chapter 2: statics of fluids
- Chapter 3: kinematics and types of fluid flow
- Chapter 4: Ideal fluids : Bernoulli theorem
- Chapter 5: Newtonian viscous fluids : Navier-Stokes equations
-balance equations (mass and momentum) : Euler theorem
-computation of energy losses coefficients (singular and regular)
-outflow and pressure measures
-study of basic hydraulic systems

BIBLIOGRAPHY

1. Comolet, R. (1961). Mécanique expérimentale des fluides. vol 1, statique et dynamique des fluides non visqueux. Masson.
2. Comolet, R. (1966). Mécanique expérimentale des fluides. vol 2, Masson.
3. Monavon, A. (2010) Mini Manuel de Mécanique des Fluides, 1ère éd. Dunod.
4. Amiroudine, S., & Battaglia, J. L. (2017). Mécanique des fluides-3e éd.: Cours, 70 exercices corrigés. Dunod.

PRE-REQUISITES

Bac+2

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20 Avenue Albert Einstein - 69100 VILLEURBANNE

Projet conception et TP / Air conditioning and acoustic design of a building

IDENTIFICATION

CODE GCU-3-S2-EC-CONCEPTION

ECTS : undefined

HOURS

Cours :	0h
TD :	16h
TP :	15h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	29h
Total :	61.5h

ASSESMENT METHOD

- project report
- defence of the project
- final examination (2h): concerns laboratory work and design project

TEACHING AIDS

- Course material given during the lessons
- Digital documents available
- User manuels for simulation software (CATT Acoustic and CODYBA)

TEACHING LANGUAGE

CONTACT

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M. JOHANNES Kevyn :
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AIMS

This sheet falls within the Course Unit GCU-S 5-Ph-Bat -1, "Building Physics - 1" and contributes to:
General Skills in Science for the Engineer:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 2)
A6- Communicate a scientific analysis or approach with adapted situational conditions to the specialty (level 2)

Skills specific to the speciality domain :
C15- Design and control good technical solutions for buildings in terms of thermal, airflow,acoustics (level 2)
C23- Contribute to a multidisciplinary design of buildings (architectural interactions - soil - structure - building physics - economy -¿);

By mobilizing the following skills :
B3- Interact with others, work as a team
B4- FShow creativity, innovate and undertake
C-25 Contribute to sustainable planning and sustainable construction

By allowing the student to work and be assessed on the following knowledge:
- knowledge developed in the "acoustic" course (GCU-S6-AC)
- knowledge developed in the "air conditioning" course (GCU-S6-CLI)

By allowing the student to work and be assessed on the following abilities:
- propose and analyze technical solutions in air conditioning and acoustic treatment of a building
- pre-size an air conditioning system under extreme winter and summer conditions,
- implement design methods using simulation tools,
- analyze simulation results and return results with critical mind,
- propose innovative and sustainable solutions

CONTENT

Project :
- sizing air conditioning system of a building and propose its acoustic treatment
- the interactions between the technical viewpoints are highlighted as well as the influential parameters that do not interact

BIBLIOGRAPHY

- Manuel de Conditionnement d'Air - G. Andreieff de Notbeck - PYC EDITION T1 et 2

- Manuel Pratique du Génie Climatique- Tome 1 Données fondamentales, Recknagel et Spenger - PYC Edition

- MANUEL CARRIER 1er partie Carrier International LTP New York.

- Climatisation conditionnement d'air traitement de l'air tome 1 : traitement de l'air, J.Bouteloup, Editions Parisiennes, ISBN 2-86 243 039-0

- Manuel d'Acoustique Fondamentale - Michel Bruneau - Editions HERMES ISBN 2-86601-712-9

- Frédéric KUZNIK, Cours Acoustique du Bâtiment- INSA Dpt.GCU, 2018

- Thierry Malet, Acoustique des Salles, Sono Mag, ISBN 2-85110-280-X

- Michel Chagué, Acoustique de l'habitat,Le Moniteur, ISBN 2-281-11208-X

PRE-REQUISITES

- Heat and mass transfers in buildings,
- Elementary thermodynamics,
- Partial derivative equations

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Building Acoustics

IDENTIFICATION

CODE : GCU-3-S2-EC-AC
ECTS : 1.5

HOURS

Cours :	8h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

written exam: 2h

TEACHING AIDS

Handouts of the course

TEACHING LANGUAGE

French

CONTACT

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AIMS

This sheet falls within the Course Unit GCU-3-S2-UE-Ph-Bat -1, "Building Physics - 1" and
contributes to:
General Skills in Science for the Engineer:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)

Skills specific to the speciality domain :
C15- Design and control good technical solutions for buildings in terms of thermal, airflow,acoustics (level 2)
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance (level 2)

By allowing the student to work and be assessed on the following knowledge:
- Acoustics
- Equation of waves and solutions.
- Physical and physiological characterization of the waves.
- Frequency analysis of noises.
- Radiation of sources and laws of propagation in open space.
- Acoustic field of pressure in closed space.
- Insulation acoustic of the building walls.
- Tool for simulation in architectural acoustics
- Acquisition and treatment of the acoustic signals.

By allowing the student to work and be assessed on the following abilities:
- calculate the pressure fields in buildings
- calculate the acoustic insulation of buildings
- assess the acoustic quality of a space
- assess noise pollution inside and outside buildings

CONTENT

- Acoustics
- Equation of waves and solutions.
- Physical and physiological characterization of the waves.
- Frequency analysis of noises.
- Radiation of sources and laws of propagation in open space.
- Acoustic field of pressure in closed space.
- Insulation acoustic of the building walls.
- Tool for simulation in architectural acoustics
- Acquisition and treatment of the acoustic signals.

BIBLIOGRAPHY

- Manuel d'Acoustique Fondamentale, Michel Bruneau - Editions HERMES ISBN 2-86601-712-9
- Cours Acoustique du Bâtiment, INSA Dpt.GCU: Gérard Krauss et René Yezou
- Acoustique des Salles, Thierry Malet - Sono Mag - ISBN 2-85110-280-X
- Acoustique de l'habitat, Michel Chagué - Le Moniteur - ISBN 2-281-11208-X
- Réglementation acoustique dans les bâtiments, Mathieu MEISSER - Techniques de l'Ingénieur
- Rappel d'acoustique physique, Gilles REIGNER - Techniques de l'Ingénieur

PRE-REQUISITES

- Partial derivative equations,
- Series and integrals of Fourier.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Air conditioning

IDENTIFICATION

CODE : GCU-3-S2-EC-CLI
ECTS : 1.50

HOURS

Cours :	8h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	21.5h
Travail personnel :	15h
Total :	36.5h

ASSESMENT METHOD

Ongoing evaluation
Written exam

TEACHING AIDS

Polycopiés cours TD et TP

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S2-UE-Ph-Bat-2 "Building physics" and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)
A2- Operate a model of a real or virtual system
A4- Design a system that meets specifications
A6- Communicate a scientific analysis or approach

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously
B3- Interact with others, work as a team
B4- Demonstrate creativity, innovate and undertake
B5- Act responsibly in a complex world
B6- Position oneself, work, evolve within a company or a socio-productive organization

Competences specific to the specialty:
C15- Design and control good technical solutions for buildings in terms of thermal, airflow, acoustics
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance

CONTENT

Air-conditioning
Characteristic dimensions of the moist air
Construction and exploitation of the moist air diagram
Transformations used into air conditioning
Typology of the systems.
Study of a air conditioning central station unit.

BIBLIOGRAPHY

- Manuel de Conditionnement d'Air - G. Andreieff de Notbeck - PYC EDITION T1 et 2
- Manuel Pratique du Génie Climatique- Tome 1 Données fondamentales, Recknagel et Spenger - PYC Edition
- MANUEL CARRIER 1er partie Carrier International LTP New York.
- Climatisation conditionnement d'air traitement de l'air tome 1 : traitement de l'air. J.Bouteloup, Editions Parisiennes, ISBN 2-86 243 039-0
- Manuel d'Acoustique Fondamentale - Michel Bruneau - Editions HERMES ISBN 2-86601-712-9
- Cours Acoustique du Bâtiment- INSA Dpt.GCU: Gérard Krauss et René Yezou
- Acoustique des Salles, Thierry Malet, Sono Mag, ISBN 2-85110-280-X
- Acoustique de l'habitat, Michel Chagué, Le Moniteur, ISBN 2-281-11208-X

PRE-REQUISITES

Documentary research (PC-S1-DOC)

Algorithms and computer programming (PC-S1-IF)
Algorithms and computer programming (PC-S2-IF)
Algorithms and computer programming (PC-S3-IF)
Algorithms and computer programming (PC-S4-IF)

Mathematics for applied sciences (PC-S1-OM)
Mathematics for applied sciences (PC-S1-OM-P)

Thermodynamics (PC-S2-TH)
Heat transfer (GCU-3-S1-EC-TC)

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Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Soil Mechanics

IDENTIFICATION

CODE : GCU-3-S2-EC-MS
ECTS : 4.00

HOURS

Cours :	14h
TD :	22h
TP :	16h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	54h
Travail personnel :	30h
Total :	84h

ASSESMENT METHOD

Written Exam: 2h
Report on laboratory work
Project reporting

TEACHING AIDS

Copy of the course
Copy of the laboratory work

TEACHING LANGUAGE

CONTACT

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AIMS

This course contributes to the acquisition of the following skills:
Skills in engineering sciences:
A2- Operate a model of a real or virtual system
A3- Implement an experimental approach
A5- Processing data

Skills schools in humanity, documentation and physical education and sports:
B2- Work, learn, evolve autonomously
B3- Interact with others, work as a team

Skills specific to the speciality:
C2- Perform and/or interpret geotechnical laboratory tests for classification and behavior
C3- Evaluate a risk of slope failure under various stresses;

By allowing the student to work and be evaluated on the following knowledge:
- the flow of water in the soil, Darcy's law and soil permeability, the flow networks, flow forces, laboratory and in situ water tests
- fundamental and theoretical aspects of compaction and soil failure; laboratory experiments that provide access to the parameters of compressibility and rupture;
- mechanisms and theories of landslide and slope stability;
- calculation methods of the failure mechanism

By allowing the student to work and be evaluated on the following abilities:
- to calculate the initial stresses, overload effect, deformations and settlements
- to control the compressibility and shear mechanisms of the different types of soil;
- to reproduce the different stress states in Mohr's plan
- to perform laboratory tests (oedometric, triaxial and shear) and in situ, and interpret the results to evaluate soil behavior
- treat the failure mechanisms of Mohr-Coulomb criterion, slopes stability

CONTENT

- Deformations and settlements in soils: compressibility oedometer test
- Characteristic stress states in the Mohr plane
- Shear strength of soils: Mohr-Coulomb failure criterion, triaxial test and straight shear test
- Shear behavior of sands and clays
- Theory and sliding slope stability.

The contributions of geotechnics to sustainable construction are discussed:
- Risks of liquefaction in soils.
- Risks of slope failure under various stresses (excess water, seismicity, etc.).
- Waterproofing problems: waste storage, groundwater pollution.

BIBLIOGRAPHY

- Afnor standards
- Cordary D. (1994) Mécanique des sols, Lavoisier - Tec & Doc
- Costet J. Sanglerat G. (1983) Cours pratique de mécanique des sols, Tome 1 : Plasticité et calcul des tassements, Dunod
- Holtz R.D., Kovacs W.D., (traduit par Lafleur J.) (2006) Introduction à la géotechnique, Editions de l'Ecole Polytechnique Montréal (réimpression)
- Parriaux A. (2006) Géologie, bases pour l'ingénieur, Presses Polytechniques et Universitaires Romandes, Lausanne-Suisse
- Philipponnat G, Hubert B (2008) Fondations et ouvrages en terre, Eyrolles, 7ème édition
- Plumelle C. (sous la direction) (2013) Théorie et pratique de la géotechnique, Le Moniteur
- Schlosser F. (2003) Eléments de mécanique des sols, Presses de l'Ecole Nationale des Ponts et Chaussées, Paris.

PRE-REQUISITES

GCU-3-S2-EC-IMSR

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Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Structural design and Modelling Project

IDENTIFICATION

CODE : GCU-3-S2-EC-PMS
ECTS : 2.00

HOURS

Cours :	0h
TD :	22h
TP :	22h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	44h
Travail personnel :	26h
Total :	70h

ASSESMENT METHOD

- Progress reports
- Synthesis report and oral presentation

TEACHING AIDS

- computation software based on finite element method
- video records of the failure tests

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit : GCU-3-S2-UE-STRUCT-2 and contributes to::

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)
A2- Operate a model of a real or virtual system
A3- Implement an experimental approach
A4- Design a system that meets specifications
A5- Process data
A6- Communicate a scientific analysis or approach

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously
B3- Interact with others, work as a team
B4- Demonstrate creativity, innovate and undertake

Competences specific to the specialty:
C7- Building structure (design, dimension and control a...)
C8- Civil Engineering Structures (design, dimension and control a...)

Allows the student to work and be evaluated on the following abilities:
design and build a physical model of a bridge from a set of specifications
modelize by the finite element method to estimate its stiffness and understand how it works
interpret and analyze the results of the experimental failure test
work on a team to imagine, design, carry out, analyze and communicate your results

CONTENT

Design and construction of wood bridge specimens during the immersion week: intuitive design according to imposed specifications - realisation (by group of students).

Failure tests on wood bridge specimens with structural rigidity measure as well as strength of the specimen ; calculus of a structural performance index.
Characterisation tests for mechanical characteristics of employed materials: wood and cord.

Three successive modelling supported by theoretical curses in structural analysis methods: finite element modelling for bar and beam systems.

Synthesis allows a confrontation between experimental and numerical approaches as well as a feed-back on the intuitive initial design.

BIBLIOGRAPHY

PRE-REQUISITES

Continuum solid mechanics (GCU-3-S1-EC-MMC)
Structural analysis methods (GCU-3-S1-EC-IAS-1)
Structures analysis methods(GCU-3-S2-EC-MAS-1)

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Structural Analysis Methods 1: Analytical Methods

IDENTIFICATION

CODE : GCU-3-S2-EC-MAS-1
ECTS : 2.00

HOURS

Cours :	8h
TD :	24h
TP :	4h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	38h
Travail personnel :	18h
Total :	56h

ASSESMENT METHOD

Written exam

TEACHING AIDS

Duplicated documents
On-line documents
Finite Element software

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit : GCU-3-S2-UE-STRUCT-2 and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)
A2- Operate a model of a real or virtual system

Competences specific to the specialty:
C7- Building structure (design, dimension and control a¿)
C8- Civil Engineering Structures (design, dimension and control a¿)

Mobilizes the following competences
Theoretical fundamentals of force and displacement methods based on virtual work principle for structural analysis.
Analytical calculus tools of statically indeterminate bar and beam systems.

Allows the student to work and be evaluated on the following abilities:
To be able to determine forces and displacements in statically indeterminate structures composed of bars and beams.

CONTENT

Virtual work principle:
Presentation of force and displacement methods based on virtual work principle

Calculus method:
Application to displacement and force methods for bar systems and beam systems (Mohr method, three-moment method, matrix stiffness method and rotation method)

BIBLIOGRAPHY

CARPINTERI A. Structural Mechanics : A unified approach. Chapman&Hall, ISBN 0419191607, 2000.
ZIENKIENWICZ O.C. et TAYLOR R.L. The Finite Element Method, vol. 1 et 2. MCGRAW-HILL, 1991.

PRE-REQUISITES

GCU-3-S1-EC1-MMC Continuum Solid Mechanics
GCU-3-S1-EC-IAS Introduction to structural analysis

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Structural Analysis Methods 2: Finite Elements Method

IDENTIFICATION

CODE : GCU-3-S2-EC-MAS-2
ECTS : 2.00

HOURS

Cours :	10h
TD :	12h
TP :	4h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	26h
Travail personnel :	20h
Total :	46h

ASSESMENT METHOD

Practical work report
Project report on a numerical discretisation of a structure

TEACHING AIDS

Duplicated documents
Numerical matrix calculation software

TEACHING LANGUAGE

French

CONTACT

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AIMS

This sheet falls within the Course Unit GCU-3-S2-UE-STRUCT-2 (Structures - 2) and contributes to:

General Skills in Science for the Engineer:
A1 - Analyze a real or virtual system (or problem) (level 2)
A2 - Operate a model of a real or virtual system (level 2)

Skills specific to the speciality domain :
C7 - Building structure (design, dimension and control a...) (level 1)
C8 - Civil Engineering Structures (design, dimension and control a...) (level 1)

By allowing the student to work and be assessed on the following knowledge:
-determining displacements, strain and stress fields in hyper-static structures made of bars, beams and in 2D systems.
-simulating the mechanical problem in the framework of a numerical computation of balance equations written in weak form.

By allowing the student to work and be assessed on the following abilities:
-developing knowledges about fundamental theory and approximation assumption of displacement field using the principe of virtual power (PV*P)
-solve the discretised weak form using numerical techniques
-apply these tools to bar systems, beam systems and 2D systems

CONTENT

principe of virtual power (PV*P)

Finite element method:
Framework of the method, approximations, finite element families, stiffness matrix and nodal force ; application on bar, beam and 2D systems.

Practical works:
Computation of the stiffness matrix of bar and 2D elements and their assembly in order to solve a structural mechanics problem.

Experimental analysis of a 2D structure by using two methods: strain measurement and digital image correlations method.
Comparison with an analytical approach and a finite element numerical methods.

BIBLIOGRAPHY

Jean-Louis Batoz et Gouri Ghatt. Modélisation des structures par éléments finis. Hermès, 1990.
ZIENKIENWICZ O.C. et TAYLOR R.L. The Finite Element Method, vol. 1 et 2. MCGRAW-HILL, 1991.

PRE-REQUISITES

Initiation to structural analysis
Continuum Solid Mechanics

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Contruction Processes

IDENTIFICATION

CODE : GCU-3-S2-EC-PGC
ECTS : 1.00

HOURS

Cours :	16h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	17h
Travail personnel :	7h
Total :	24h

ASSESMENT METHOD

MCQ

TEACHING AIDS

On-line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S2-UE-STRUCT-2 and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 1)

Competences specific to the specialty:
C7- Building structure (design, dimension and control a¿) (level 1)
C8- Civil Engineering Structures (design, dimension and control a¿) (level 1)
C9- Highway and rail infrastructure (design, dimension and control a¿) (level 1)
C12-Assess several building methods (level 1)
C24- Contribute to organize construction sites, to the compliance of safety rules and deadlines (level 1)

Allows the student to work and be evaluated on the following knowledge:
Functional analysis of structures
Realisation processes and appropriate calculus methods
Safety on construction site

Allows the student to work and be evaluated on the following abilities:
To know the main constructive systems, set up techniques
To know the different steps of design and construction

CONTENT

1 - Constructive systems for building
2 - Safety and work side organization
3 - Bridges
4 - Road and earthwork

Construction site tours

BIBLIOGRAPHY

KARSENTY G. La fabrication du bâtiment : le gros oeuvre. Eyrolle, 1997.
Normes et Documents Techniques Unifiés associés aux règles de calcul
VITTONE R. Bâtir : manuel de la construction. Presses Polytechniques et universitaires romandes, 1996.

PRE-REQUISITES

GCU-3-S1-EC-IAS1
GCU-3-S1-EC-IAS2

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Reinforced Concrete Structures

IDENTIFICATION

CODE : GCU-3-S2-EC-BA
ECTS : 3.00

HOURS

Cours :	20h
TD :	16h
TP :	7h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	43h
Travail personnel :	20h
Total :	63h

ASSESMENT METHOD

Poject
Practical work reports

TEACHING AIDS

Duplicated documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S2-UE-STRUCT-2 and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 2)

Competences specific to the specialty:
C7- Building structure (design, dimension and control a...) (level 2)

Allows the student to work and be evaluated on the following knowledge:
Design principles for reinforced concrete structure according to EUROCODES 0, 1 and 2;
Properties of constitutive materials (steel and concrete)
Calculus basis at limit states (service and ultimate states)
Environmental and durability classes
Beam cross section requirements with normal and shear forces

Allows the student to work and be evaluated on the following abilities:
To Design statically determinate rienforced concrete structure according to EUROCODES 0, 1 and 2
To integrate the durability notion in civil engineering projects

CONTENT

1 - Introduction to Eurocodes - Eurocodes 0, 1, and 2
2 - Properties of materials
3 - Steel/concrete bond
4 - Bending at Ultimate Limite State
5 - Bending at Serviceability Limite State
6 - Shear resistance

BIBLIOGRAPHY

Paillé J.M. (2009). Calcul des structures en béton. AFNOR. Editions Eyrolles, Paris, France; Roux J. (2009). Pratique de l'Eurocode 2. AFNOR. Editions Eyrolles, Paris, France; Roux J. (2009). Maîtrise de l'Eurocode 2. AFNOR. Editions Eyrolles, Paris, France; Ricotier D. (2012). Dimensionnement des structures en béton selon l'Eurocode 2. Edition Le Moniteur, Paris, France; NF EN 1990 (Mars 2003). Eurocodes structuraux - Bases de calcul des structures. AFNOR; NF EN 1991 (Juillet 2001). Actions sur les structures. AFNOR; NF EN 1992 (Avril 2003). Eurocode 2 - Calcul des structures en béton. AFNOR.

PRE-REQUISITES

GCU-3-S1-EC-IAS1
GCU-3-S1-EC-AS2

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DAO-SIG / CAD-GIS

IDENTIFICATION

CODE : GCU-3-S2-EC-DAO-SIG
ECTS : 1.00

HOURS

Cours :	2h
TD :	6h
TP :	8h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	16h
Travail personnel :	14h
Total :	30h

ASSESMENT METHOD

CAD:
Continuous during the TP sessions

GIS:
The assessment will be a folder with:
- a cartography in jpeg, pdf format ;
- a database;
- a QGIS project.

TEACHING AIDS

PDF on moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

GCU-3-S2-UE-OUTILS-2

CAD:
Computer Aided Drawing (CAD) is a discipline that produces technical drawings with computer software. It is distinguished from image synthesis in that it does not involve the rendering of a numerical model but the execution of graphical commands (lines, various forms ...). As a result, in DAO, the mouse and the keyboard replace the pencil and other instruments of the designer.
Have a first level of knowledge of the panorama of the DAO tools of the market and master the functionalities required in the tool of CAD most used in the sector (Autocad) 2D and 3D.
Second part of this EC allows the student to work on a new CAD tool - Revit. 3D modeling software dedicated to the building sector, Revit brings together the fields of activity of architecture, fluids and structure. New flagship of the Autodesk editor, it integrates the concepts of BIM (Building Information Modeling), which allows to capitalize all the data of the lifecycle of a construction.

GIS:
Introduction to GIS (Geographic Information System)

The objectives of the course are to:
- understand the different types of geomatic data;
- understand the usefulness of GIS;
- retrieve, work with, analyze and visualize geomatic data;
- create a cartography.

CONTENT

1. AUTOCAD :
- AutoCAD Basic Tools
- Wired 2D - Ex. Building
- 2D-3D Relations, Paper Space
- 3D work, Surfaces & Solids
2. REVIT :
-Presentation of REVIT
-Modeling step by step: grids; level; post; beam; Wall ; opening ; floor; roofing; balcony; terrace; staircase; vault ; foundation
- Family
- Reinforcement
-Leaves, cartridges and layout

GIS:
Software used:
- QGIS (https://www.qgis.org/fr/site/) ;
- Excel ;
- Illustrator (option).

BIBLIOGRAPHY

PRE-REQUISITES

None

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
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Decision support - 1

IDENTIFICATION

CODE : GCU-3-S2-EC-AD1
ECTS : 2

HOURS

Cours :	8h
TD :	14h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	24h
Travail personnel :	20h
Total :	44h

ASSESMENT METHOD

project(s) (25% of the evaluation) + 1 final examination (2h) (75% of the evaluation)

TEACHING AIDS

Course material given during the lessons + Digital documents available

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S2-UE-OUTILS-2 (Tools for Engineers) and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)(Level 2)
A2- Operate a model of a real or virtual system(Level 2)
A5- Process data (Level 3)
A6- Communicate a scientific analysis or approach (Level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (Level 2)
B3- Interact with others, work as a team (Level 2)
B5- Act responsibly in a complex world(Level 1)

Competences specific to the speciality:
C25- Contribute to design and describe sustainable urban planning and constructions(level 1)
C26- Manage (essess, maintain) existing structures and facilities (level 1)

Allows the student to work and be evaluated on the following knowledge:
- Fundamentals of decision theory (A1, A5, C25, C26)
- Optimization methods(A2, C25, C26)
- Multicriteria decision-aid methods(A5, A6, C25, C26)

Allows the student to work and be evaluated on the following abilities:
- choose and apply an optimization method (A5, C26,B2)
- choose and apply a multicriteria decision-aid method with critical distance : aggregation approach, multi-criteria decision analysis approaches including ELECTRE II, ELECTRE III and ELECTRE TRI (A2, A6, C25, C26, B2, B3, B5)

CONTENT

1. Introduction and overall concepts: Systems and Decision, Decision theory models, criterion definition and preference modelling

2. Multivariate optimization methods

3. Life cycle assessment - LCA

4. Multicriteria decision-aid methods (MCDA)
4.1. Two approaches: aggregate and compare vs compare and aggregate
4.2. Definition of weighting factors in MCDA
4.3. Aggregation methods
4.4. Outranking methods using true criteria (ELECTRE II), pseudo criteria (ELECTRE III and Tri)
4.5. Problem setting, choice and implementation of methods on real life problems

BIBLIOGRAPHY

Bruen, M., Maystre, L.Y., Rogers, M.G. (2000). ELECTRE and decision support. Methods and applications in engineering and infrastructure investment. Kluwer Academic Publishers,224 p.
Pomerol, J.C., Barba-Romero, S. (2000). Multicriterion Decision in Management Principles and Practice. Springer Science + Business Media New York, 389p.
Roy, B. (1996). Multicriteria methodology for decision aiding. Dordrecht (The Netherlands): Kluwer Academic Publishers, 292p.
Vinke,P. (1992). Muticriteria decision-aid. Chichester (England): John Wiley & Sons, 154 p.

PRE-REQUISITES

Scientific Bachelor degree + 2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Surveying

IDENTIFICATION

CODE : GCU-3-S2-EC-TOP
ECTS : 1.00

HOURS

Cours :	4h
TD :	11h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	16h
Travail personnel :	10h
Total :	26h

ASSESMENT METHOD

Written exam 2h

TEACHING AIDS

Duplicated documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-3-S2-UE-OUTILS-2 and contributes to:

Competences in Engineering Science:
A5- Process data

Competences in Humanities, Documentation and Physical and Sports Education:
B3- Interact with others, work as a team

Competences specific to the specialty:
C24- Contribute to organize construction sites, to the compliance of safety rules and deadlines

Allows the student to work and be evaluated on the following knowledge:
- Master the use of topographic devices - levels, theodolites, distance-meters - to achieve a leveling.
- Perform angular measurements and distances.
- Establish a map of a defined area.

Allows the student to work and be evaluated on the following abilities:
- General principles of topography and estimation of errors.
- Principle of direct leveling.
- Angular and distance measurements: theodolites and distance-meters.
- Topographic calculations.

CONTENT

Aims are to propose a training in surveying :

- General introduction and error estimation,
- Principals of levelling and field work,
- Angular and distance measurements (Theodolites and distance-meters),
- Field measurements and realisation of topographic plans (by using autocad),
- Setting out a new building project.

BIBLIOGRAPHY

Brabant, M. (2000). Maîtriser la topographie : des observations au plan. Paris : Eyrolles, 552 p.

PRE-REQUISITES

Trigonometry

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Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Discovery internship

IDENTIFICATION

CODE : GCU-3-S2-EC-STGF
ECTS : 0.00

HOURS

Cours :	0h
TD :	2h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	2h
Travail personnel :	0h
Total :	2h

ASSESMENT METHOD

The internship lasts between 4 and 8 weeks (minimum 4 consecutive weeks) and is designed to introduce students to the engineering profession. It must be carried out in a company or organization whose main sector of activity is civil engineering and urban planning.

The internship is assessed in several ways:
- the student's ability to find an internship related to the GCU course within the allotted timeframe
- the assessment based on the evaluation form provided by the company
- the quality of the compulsory summary report and compliance with the report deadline.

TEACHING AIDS

INSA Lyon/GCU, “Acquis-de-l-apprentissage-visés-par-la-formation-GCU.” Document available on the digital space.

TEACHING LANGUAGE

French

CONTACT

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AIMS

SKILLS :
This CE is part of the Stage 3GCU teaching unit and contributes to the following competencies
following competencies:
A1 Analyze a real or virtual system (or problem) (level 2)
A3 Implement an experimental approach (level 2)
A4 Design a system to meet specifications (level 2)
A5 Process data (level 2)
A6 Communicate a scientific analysis or approach, using real-life situations adapted to their specialty (level 2)
B1 Know oneself, manage oneself physically and mentally (level 2)
B2 Work, learn and develop independently (level 2)
B3 Interact with others, work as part of a team (level 2)
B4 Be creative, innovative, enterprising (level 2)
B5 Act responsibly in a complex world (level 2)
B6 Situate oneself, work and evolve in a company or socio-productive organization (level 2)

CONTENT

Internship lasting 4 to 8 weeks.

BIBLIOGRAPHY

INSA Lyon/GCU, “Acquis-de-l-apprentissage-visés-par-la-formation-GCU.” Document available on the digital space.

PRE-REQUISITES

GCU-3-S1 and GCU-3-S2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Soil / structure interaction

IDENTIFICATION

CODE : GCU-4-S1-EC-ISS
ECTS : 3

HOURS

Cours :	18h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	40.5h
Travail personnel :	33h
Total :	73.5h

ASSESMENT METHOD

Final assignment (50%)
Project - written part (25%)
Project - oral part (25%)

TEACHING AIDS

Course material on the server and handout distributed

TEACHING LANGUAGE

French

CONTACT

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AIMS

This CA is part of the teaching unit GCU-4-S1-UE-ISS and contributes to:

Skills science schools for engineers:
A1- Analyze a real or virtual system (or problem) (level 2);
A2- Operating a model of a real or virtual system (level 2);
A4- Designing a system that meets specifications (level 2);
A5- Data processing (level 2);
A6- Communicate an analysis or a scientific approach with situations adapted to the specialty (Level 2);

School skills in humanities, documentation and physical and sports education
B2 - Work, learn and grow independently

Skills specific to the subject:
C5- Design, dimension, model or verify foundation and support systems (level 2);
C6- Design, size, model or verify foundation and support (level 2);

Allowing the student to work and be assessed on the following knowledge:
- the nature of a rock and its formation history;
- the mechanical behaviour of a rock;
- the identification of discontinuities;
- the stability of rock masses.

CONTENT

Geotechnical
Slope stability
Thrust-thrust calculations
Dimensioning of retaining walls
Screen sizing
Dimensioning of shallow and deep foundations

In rock mechanics
- General presentation of rock mechanics
- Physical and mechanical properties of rocks
- Discontinuities and mechanical behaviour
- Modelling physical properties of soils and rocks
- Requirements imposed and conditions on limits
- Visualisation and exploitation of the results of numerical calculations.

BIBLIOGRAPHY

Eurocode 7 : Application aux fondations superficielles (NF P94-261) - cerema - Numéro ISBN 978-2-37180-102-8
Eurocode 7 - Application aux fondations profondes (NF P94-262) - cerema - Numéro ISBN 978-2-37180-046-5
Eurocode 7 - Application aux écrans de soutènement (NF P94-282) - cerema - Numéro ISBN 978-2-37180-143-1
Eurocode 7 - Application aux murs (NF P94-281) - cerema - Numéro ISBN 978-2-37180-185-1

PRE-REQUISITES

GCU-3-S1-EC-IMSR and GCU-3-S2-EC-MS

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Multi-Materials, Constructions and Innovative Building Systems

IDENTIFICATION

CODE : GCU-4-S1-EC-SCI
ECTS : 1.00

HOURS

Cours :	8h
TD :	8h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	16h
Travail personnel :	36h
Total :	52h

ASSESMENT METHOD

Project

TEACHING AIDS

Duplicated documents
On-line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This course based on a project approach is developed with a vision Materials Multi-Materials Eco-Constructions and Innovative Building Systems. It is a question, for the students, of seizing the recent results of the research in materials and constructive processes, and of designing a structural element, a construction (house or building), or constructive process, innovating and at the service of a sustainable construction or eco-construction. In their approach and for the purpose of justifying the proposed innovations, students can rely on the various examples illustrated in the course and also on research through scientific publications.

CONTENT

- Current issues in the construction world & solutions in the current context of decarbonization of construction. How to reduce the CO2 balance: choice of alternative materials; design choice: Archi and Engineers
- Earth construction
- Additive manufacturing applied to concrete: 3D printing
- Fiber-reinforced concrete & Modular housing
- Biobased materials
- Others

BIBLIOGRAPHY

Avila, F., Puertas, E., & Gallego, R. (2021). Characterization of the mechanical and physical properties of unstabilized rammed earth: A review. Construction and Building Materials, 270, 121435.

Bui, T. T., Limam, A., Desevedavy, G., & Damichey, D. (2022). Highly environmental-efficient modular houses considering construction and deconstruction aspects. In CIGOS 2021, Emerging Technologies and Applications for Green Infrastructure: Proceedings of the 6th International Conference on Geotechnics, Civil Engineering and Structures (pp. 657-665). Springer Singapore.

Nguyen, T. D., Bui, T. T., Limam, A., Bui, T. L., & Bui, Q. B. (2021). Evaluation of seismic performance of rammed earth building and improvement solutions. Journal of Building Engineering, 43, 103113.

Jami, T., Karade, S. R., & Singh, L. P. (2019). A review of the properties of hemp concrete for green building applications. Journal of Cleaner Production, 239, 117852

PRE-REQUISITES

-Knowledge of the mechanical behavior and physical properties of Civil Engineering materials.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Advanced Structural Analysis - 1

IDENTIFICATION

CODE : GCU-4-S1-EC-EAS1
ECTS : 1.00

HOURS

Cours :	8h
TD :	10h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	19.5h
Travail personnel :	9h
Total :	28.5h

ASSESMENT METHOD

Written exam

TEACHING AIDS

Duplicated documents
On-line documents
MATLAB Software

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-4-S1-UE-STR-3 and contributes to :

Competences in Engineering Science:
A1 - Analyze a real or virtual system (or problem) (level 2)
A2 - Operate a model of a real or virtual system (level 2)

Competences specific to the specialty :
C7 - Building structure (design, dimension and control a buiding) ; (level 2)
C8 - Civil Engineering Structures (design, dimension and control a bridge) ; (Level 2)
C25 - Contribute to sustainable urban developments and sustainable construction ; (Level 1)

Allows the student to work and be evaluated on the following knowledge:
- dynamics of structures
- modal decomposition of a system in dynamics (eigenfrequencies and modal shapes)

Allows the student to work and be evaluated on the following abilities:
- modeling Civil Engineering structures of the beam and column type under earthquake loading
- setting up the regulatory approach for simplified structures

CONTENT

Equations of motion in continuous setting
Principle of virtual work
Response spectrum related to a seismic excitation (accelerogram)
Finite element method in structural dynamics for modelling beam-column structures
Modal analysis (eigenfrequencies and modal shapes)
Modal decomposition for solving the equation of motion
Spectral analysis (regulatory approach) for a structure under earthquake loading
Direct time integration of the equation of motion

BIBLIOGRAPHY

Mechanical vibrations - Theory and application to structural dynamics. Géradin Michel, Rixen Daniel, Wiley, third edition, 2015.

Dynamics of Structures: Theory and Applications to Earthquake Engineering. Anil K. Chopra, Pearson, fifth edition, 2016.

Modélisation des structures par éléments finis - Tome 1 : Solides élastiques. Jean-Louis Batoz, Gouri Dhatt, Libraires Eyrolles, Hermès, Paris 5ème, 1990.

PRE-REQUISITES

Continuum Solid Mechanics (GCU-3-S1-EC-MMC)
Initiation to structural analysis (GCU-3-S1-EC-IAS1 et GCU-3-S1-EC-IAS2)
Advanced structural analysis (GCU-3-S2-EC-MAS-1 and GCU-3-S2-EC-MAS-2)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Prestressed Concrete Structures

IDENTIFICATION

CODE : GCU-4-S1-EC-BP
ECTS : 2.00

HOURS

Cours :	10h
TD :	16h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	26h
Travail personnel :	24h
Total :	50h

ASSESMENT METHOD

Project

TEACHING AIDS

Duplicated documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-4-S1-UE-STR-3 and contributes:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 2)

Competences specific to the specialty:
C7- Building structure (design, dimension and control a...) (level 2)

Allows the student to work and be evaluated on the following knowledge:
Rules of design according to Eurocodes 0, 1 and 2
Design and verifications reinforced concrete beams in combined bending
Functioning and design of prestressed concrete beams

Allows the student to work and be evaluated on the following abilities:
To design statically determinate reinforced concrete beams in combined bending according to Eurocodes 0, 1 and
To design statically determinate prestressed reinforced concrete beams to Eurocodes 0, 1 and 2

CONTENT

1-Combined bending and compression at service and ultimate states

2-Prestressed concrete
2.1-Generalities
2.2-Prestress loss
2.3-Elastic design
2.4-Design requirements

BIBLIOGRAPHY

NF EN 1990 (Mars 2003). Eurocodes structuraux - Bases de calcul des structures. AFNOR.
NF EN 1991 (Juillet 2001). Actions sur les structures. AFNOR.
NF EN 1992 (Avril 2003). Eurocode 2 - Calcul des structures en béton. AFNOR.
Annexe Nationale à la NF EN 1992-1-1 (Mars 2007). AFNOR
Recommandations professionnelles pour l'application de la norme NF EN 1992 -1-1 et de son annexe nationale relative aux calculs des structures en béton (mars 2007). Editions SEBTP.

EFB (2008). Application de l'Eurocode 2. Presse de l'ENPC. Paris, France.
Le Delliou P. (2003). Béton précontraint aux Eurocodes. ENTPE, Presses Universitaires de Lyon, France.
Roux J. (2009). Maîtrise de l'Eurocode 2. AFNOR. Editions Eyrolles, Paris, France.

PRE-REQUISITES

GCU-3-S2-EC-BA
GCU-3-S1-EC-IAS1
GCU-3-S1-EC-IAS2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Advanced Structural Analysis - 2

IDENTIFICATION

CODE : GCU-4-S1-EC-EAS2
ECTS : 1.00

HOURS

Cours :	4h
TD :	6h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	11.5h
Travail personnel :	13h
Total :	24.5h

ASSESMENT METHOD

- Written exam

TEACHING AIDS

On-line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This sheet falls within the Course Unit GCU-4-S1-UE-STR-3 and contributes to:

General Skills in Science for the Engineer:
A1 - Analyze a real or virtual system (or problem) (level 2)
A2 - Operate a model of a real or virtual system (level 2)

Skills specific to the speciality domain :
C7 - Building structure (design, dimension and control a...) (level 1)
C8 - Civil Engineering Structures (design, dimension and control a...) (level 1)

By allowing the student to work and be assessed on the following knowledge:
-solve non linear structures and materials concerning plasticity, plastic hinges, limit kinematic analysis

By allowing the student to work and be assessed on the following abilities:
-developing knowledges assumption of displacement field using the principe of virtual power (PV*P)
-solve non linear beam element structures (with plasticity, plastic hinges)

CONTENT

Non linear behaviour : Incremental method for the analysis of perfect elastoplastic structures composed of beams ; limit analysis method (kinematic analysis)

BIBLIOGRAPHY

TIMOSHENKO S. Théorie des plaques et des coques. Beranger, 1951.
TIMOSHENKO S. Théorie de la stabilité élastique. Beranger, 1947.
MASSONNET C., CESCOTTO S. Mécanique des matériaux. Eyrolles, 1980
MANDEL J. Propriétés mécaniques des matériaux : rhéologie, plasticité. Eyrolles, 1978.
MASSONNET C., SAVE M. Calcul plastique des constructions. Centre belgo-luxembourgeois d'information de l'acier, 1967.

PRE-REQUISITES

GCU-3-S1-EC-MMC (Continuum Solid Mechanics)
GCU-3-S1-EC-IAS1 et GCU-3-S1-EC-IAS2 (Initiation to structural analysis)
GCU-3-S2-EC-MAS-1 et GCU-3-S2-EC-MAS-2 (Structural analysis methods)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Steel Structures

IDENTIFICATION

CODE : GCU-4-S1-EC-CMM1
ECTS : 2.00

HOURS

Cours :	8h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	26h
Travail personnel :	24h
Total :	50h

ASSESMENT METHOD

Steel Project évaluation

TEACHING AIDS

Duplicated documents
On-line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This teaching contributes to the acquisition of the following skills :

- Design and dimensioning / Building control.

Abilities

- Dimensioning and checking building steel structures with the Eurocode 3.

Knowledge :

- cross sections classification,
- limit stats justifications for the design standard Eurocode 3,
- Global analyses and failures modes (plastic hinging, buckling and lateral buckling),
- Connections (bolted joint, steel welding),
- fire design.

CONTENT

- Design rules according to EUROCODES 3
- Cross Section classification
- Section resisting and beam or column stability verifications under simple or composed bending and shear
- Design of steel component assembling
- Fire engineering design codes for steel

BIBLIOGRAPHY

EN1993-1-1 : Eurocode 3. Calcul des structures en acier.
EN 1994-1-1 : Eurocode 4. Conception et dimensionnement des structures mixtes acier-béton.
P.BOURRIER, J.BROZZETTI. Construction métallique et mixte acier-béton. Eyrolles, 1996.
J.MOREL. Structures métalliques. Eyrolles, 1995.

PRE-REQUISITES

GCU-3-S1-EC-IAS1
GCU-3-S1-EC-IAS2
Initiation to structural analysis (stability, barres and beams theory)
GCU-3-S2-EC-MAS-1
GCU-3-S2-EC-MAS-2
Structural analysis methods of determined and indetermined structures

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Urban Water Management

IDENTIFICATION

CODE : GCU-4-S1-EC-HUR
ECTS : 1.50

HOURS

Cours :	10h
TD :	10h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	22h
Travail personnel :	17h
Total :	39h

ASSESMENT METHOD

written exam at the end of the course

TEACHING AIDS

Slides and different general documents on line, Canoe software

TEACHING LANGUAGE

English

CONTACT

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AIMS

This module is part of the course unit GCU-4-S1-UE-HYD and contributes to:
Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (Level 2)
A2- Operate a model of a real or virtual system (Level 2)
A4- Design a system that meets specifications (Level 2)
A5- Process data (Level 2)
A6- Communicate a scientific analysis or approach (Level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (Level 2)
B5- Act responsibly in a complex world (Level 1)

Competences specific to the specialty:

Mobilizes the following competences

Allows the student to work and be evaluated on the following knowledge:

Allows the student to work and be evaluated on the following abilities:This module is part of the course unit GCU-S7-HYD and contributes to:
Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (Level 2)
A2- Operate a model of a real or virtual system (Level 2)
A4- Design a system that meets specifications (Level 2)
A5- Process data (Level 2)
A6- Communicate a scientific analysis or approach (Level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (Level 2)
B5- Act responsibly in a complex world (Level 1)

Competences specific to the specialty:
C17- Designing and sizing networks and structures based on hydrologic and hydraulic approaches for urban planning, buildings and civil engineering infrastructures (Level 2)
C18 - Quantitative analysis of hydrologic processes and to manage networks, structures and urban planning (Level 2)
C19- Environmental assessment of urban water management systems or component s(Level 1)
C25- Contribute to sustainable urban developments and sustainable construction (Level 2)
C26- Manage assets (assessment, maintenance, rehabilitation) (Level 1)

Allows the student to work and be evaluated on the following knowledge:
- Stakes of water management from the local to global scale
- Processes involved all along the urban water cycle during wet weather periods (rainfall, rainfall runoff transformation, flow regime in the different structures, notion of pollution and impact on aquatic bodies)
- Stormwater control Measures, performance evaluation, design and simulation

Allows the student to work and be evaluated on the following abilities:
- Be able to carry out a diagnostic study in terms of stormwater management
- Be able to design and simule the hydrological behavior of different structures in an urban project
- Be capable of understanding and criticising studies devoted to environmental issues

CONTENT

- General overview on water management problems in Civil Engineering and Urban Development (water cycle and the major actual stakes)
- Rainfall (phenomena, measurement and modelling)
- Rainfall-runoff transformation (losses and runoff phenomena, assessment and modelling)
- Stormwater control Measures, performance evaluation, design and simulation
- Bases of water pollution and impact on ecosystems

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Hydraulics

IDENTIFICATION

CODE : GCU-4-S1-EC-HG
ECTS : 2.50

HOURS

Cours :	10h
TD :	18h
TP :	6h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	36h
Travail personnel :	26h
Total :	62h

ASSESMENT METHOD

lab work report and exam

TEACHING AIDS

Lecture documents and slides
Document related to lab work description

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-4-S1-UE-HYD (Hydraulics) and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)
A3- Implement an experimental approach (level 2)
A5- Process data (level 2)

Specific competences:
C17- Designing and sizing networks and structures based on hydrologic and hydraulic approaches for urban planning, buildings and civil engineering infrastructures (level 2)
C18 - Quantitative analysis of hydrologic processes and to manage networks, structures and urban planning (level 2)
C19- Environmental assessment of urban water management systems or components (level 1)

Soft skills including humanity and sport:
B3- Interact with others, work as a team

Allowing the student to work and be evaluated on the following knowledges:
- graphical and computational methods to understand the behavior and to size pressurized pipe networks
- theory and operation of centrifugal pumps
- operation of water supply systems
- open channel flows (designing of river and sewer channels)
- hydraulic jump

Allowing the student to work and be evaluated on the following abilities:
- account for energy losses to size pressurized pipe networks
- sizing a pressurized conduit networks with and without centrifugal pumps and computation of conveyed flow rates
- sizing of open river and sewer channels
- analysis of backwater curves

CONTENT

- centrifugal pumps
- water supply networks
- study of discontinuities (hydraulic jump) and chocks (water hammer)
- open channel flow
- study of flows through weirs and gates
- introduction on Computational Fluid Dynamics and smoothed-particle hydrodynamics: application to the hydrodynamics and solid transport behavior of combined sewer overflow structures, settling basins, open channel junction and bufurcation

BIBLIOGRAPHY

- Carlier, M. (1972). Hydraulique générale et appliquée, édition Eyrolles.
- Lencastre, A. (1996). Hydraulique générale. Paris: Eyrolles, 633 p. ISBN 2-212-01894-0.
- Graf, W. H. (2000). Hydraulique fluviale: écoulement et phénomènes de transport dans les canaux à géométrie simple (Vol. 16). PPUR presses polytechniques.
- Pernès P. (2003). Hydraulique unidimensionnelle parties 1 et 2 - Edition Cemagref.
- Hager, W. H. (2010). Wastewater hydraulics: Theory and practice. Springer Science & Business Media.
- Sinniger, R. O., & Hager, W. H. (1989). Constructions hydrauliques - écoulements stationnaires (Hydraulic structures - steady flows). Presses Polytechniques Romandes: Lausanne

PRE-REQUISITES

GCU-3-S2-EC-MF (3GCU Fluid Mechanics course)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Urbanisme / Urban Planning

IDENTIFICATION

CODE : GCU-4-S1-EC-UR
ECTS : 2.00

HOURS

Cours :	16h
TD :	8h
TP :	0h
Projet :	0h
Evaluation :	0.5h
Face à face pédagogique :	24.5h
Travail personnel :	9h
Total :	33.5h

ASSESMENT METHOD

- 1 individual urban project

TEACHING AIDS

slides on line

TEACHING LANGUAGE

French

CONTACT

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AIMS

GCU-4-S1-UE-EU :
COMPETENCES :
B3- Interact with others, work as a team
B5- Act responsibly in a complex world
C20 :

AIMS :
- to be initiated into french urban public policies
- to understand shapes, spaces and dynamics of contemporary french cities

CONTENT

- History of urban policies
- town planning and urban development in France since 1950
- urban renewal
- urban projects
- process of urban development

BIBLIOGRAPHY

Ascher F., 1995, Métapolis ou l'avenir des villes, éd. Odile Jacob, Paris
Dupuy G., 1991, L'urbanisme des réseaux, Colin, 1991
Claude V., 2006, Faire la ville, les métiers de l'urbanisme au XXème s., Parenthèses
Davis M., 2006, Le pire des mondes possibles, La Découverte.
-Grafmeyer Y. Sociologie urbaine. Nathan. 1994.
- Choay F. : L'urbanisme, utopies et réalités, Point, 2001, 448 p

PRE-REQUISITES

Students will be expected to write and express themselves in good grammatical and Standard French.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Ateliers / Workshop - Teamwork

IDENTIFICATION

CODE : GCU-4-S1-EC-AT
ECTS : 3.00

HOURS

Cours :	0h
TD :	36h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	36h
Travail personnel :	39h
Total :	75h

ASSESMENT METHOD

-A synthetic report
-A collective oral defence

TEACHING AIDS

On line documents

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-4-S1-UE-EU (urban studies and Workshops) and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A3- Implement an experimental approach(level 1)
A5- Process data(level 3)
A6- Communicate a scientific analysis or approach (level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 3)
B3- Interact with others, work as a team (level 3)
B4- Demonstrate creativity, innovate and undertake.
B5- Act responsibly in a complex world (level 1)
B6- Position oneself, work, evolve within a company or a socio-productive organization (level 1);

Competences specific to the specialty:
C20- Analyse an urban context (technical, political and social patterns at different scales) (level 2)
C23- Contribute to a pluri-disciplinary design process of buildings (level 1)
C25- Contribute to sustainable urban developments and sustainable construction (level 1)

The aim of the workshop course is to learn how to build an adapted methodology to answer a problem linked to design, construction or management in the fields of civil engineering and/or urban development within the scope of a general subject given each year. It aims more particularly at learning how to:
- identify and set a relevant question in relationship within the scope of the general subject
- build one or more methods to answer the question set
- apply the method(s) to case studies found by the working group
- process information and data collected
- conduct a critical analysis of the results and the methodology
- work in group and organize a collective activity
- disseminate the results with rigor (oral defense and report)

CONTENT

The workshops aim to initiate a reflection on the processes of urbanization in progress from an original field study. By urbanization process, we mean both the making and the use of cities and urban environments. These processes are therefore technical, spatial, social, political, organizational, legal, economic, etc. In the current context, characterized by very strong environmental pressure (advent of the Anthropocene), they raise questions and numerous problems of a technical, economic, political, social, environmental, etc. nature.

Within the framework of the workshops, these processes are considered through the act of designing, building or managing the city, from the objects of the GCU department, namely those of civil engineering and urban planning (cities, various networks, housing, buildings, tramways, urban services, etc.).

Thus, the work of the workshops consists in constructing a questioning in relation to a given theme and in implementing a field survey to answer it. This investigation is based on real case studies (located in the Lyon area) and uses methods from the social sciences and engineering sciences (in situ observations, interviews, modeling, measurements, etc.).

The workshops have multiple objectives:
- to better understand, through a particular theme and a field survey, the current urbanization processes and their social, technical, political, environmental and economic stakes;
- to participate in a reflection on the making of cities and the role of engineers in this making;
- to better understand the role of urban planning, infrastructures and constructions in general in the processes of urbanization and the possible conditions of reorientation of these processes.

The workshop is based on groups of students working on their own within two to four-hour sessions. The teaching team helps to oriente, discuss methodological aspects and provides contacts if necessary.Some shorts presentations are proposed on methodological aspects (problem setting, choice of adapted methods, data processing, way of writing bibliographical references and a synthetic report).

BIBLIOGRAPHY

This bibliography concerns cities, urban planning and the "anthropocene" in general, as well as methods in social sciences. The list is not exhaustive.

This bibliography will be completed by each group according to the given theme and their problematic.

Alexandre F. et al. (coord.), Dictionnaire critique de l'anthropocène, Paris, CNRS Editions

Beaud S., Weber F., e2003, Guide de l'enquête de terrain. Nouvelle édition, Paris, La Découverte

Becker H. S., 2002, Les ficelles du métier. Comment conduire sa recherche en sciences sociales, Paris, La Découverte

Blanchet A., Gotman A., 2006, L'enquête et ses méthodes. L'entretien, Paris, Armand Colin

Gemenne F., Rankovic A. (avec l'Atelier de cartographique de Sciences Po), 2019, Atlas de l'anthropocène, Paris, SciencesPo Les Presses

Grawitz M., e2001, Méthodes des sciences sociales, Paris, Dalloz

Lévy J., Lussault M. (dir.), 2013, Dictionnaire de la géographie et de l'espace des sociétés. Nouvelle édition revue et augmentée, Paris, Belin

Magny M., 2021, L'Anthropocène, Paris, Que sais-je/Humensis

Merlin P., Choay F. (dir.), 2005, Dictionnaire de l'urbanisme et de l'aménagement, Paris, Presses Universitaires de France

Pinçon M., Pinçon-Charlot M., 1997, Voyage en grande bourgeoisie. Journal d'enquête, Paris, Presses Universitaires de France

Pinson G., 2020, La ville néolibérale, Paris, Presses Université de France

Verdeil E. (avec l'Atelier de cartographique de Sciences Po), 2020, Atlas des mondes urbains, Paris, SciencesPo Les Presses

PRE-REQUISITES

A good level of French is required

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Introduction to Data Science

IDENTIFICATION

CODE : GCU-4-S1-EC-IDS
ECTS : 2.0

HOURS

Cours :	8h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	21h
Travail personnel :	20h
Total :	41h

ASSESMENT METHOD

Evaluation by questionnaire on Moodle (1 hour).

TEACHING AIDS

Course materials in electronic version in English.

TEACHING LANGUAGE

French

CONTACT

MME POTHIER Catherine :
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AIMS

This module is part of the course unit GCU-4-S1-UE-DD-AD and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A2- Operate a model of a real or virtual system (level 2)
A5- Process data (level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 2)
B3- Interact with others, work as a team (level 2)

Allows the student to work and be evaluated on the following knowledge:
- clustering
- supervised classification

CONTENT

The objective of this course is to explore Artificial Intelligence through various machine learning methods to learn models from data.

The topics covered in the course will be:

- Introduction to AI.
- Clustering methods including K-means, hierarchical clustering, and DB-SCAN.
- Classification methods including decision trees and random forests.

These concepts will then be applied in practical exercises using the Python language and the scikit-learn library.

BIBLIOGRAPHY

Introduction to Data Mining (2018 - Second Edition) by Tan, Steinbach, Karpatne and Kumar. https://www-users.cse.umn.edu/~kumar001/dmbook/index.php

PRE-REQUISITES

General scientific level of L3.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Life cycle analysis

IDENTIFICATION

CODE : GCU-4-S1-EC-ACV
ECTS : 2.00

HOURS

Cours :	2h
TD :	16h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	18h
Travail personnel :	10h
Total :	28h

ASSESMENT METHOD

Life Cycle Assessment Project evaluation

TEACHING AIDS

Duplicated documents
On-line documents

TEACHING LANGUAGE

French

CONTACT

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M. DAVID Damien :
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AIMS

This teaching contributes to the acquisition of the following skills :
* Targeted skills:
SPI-1: Analyze a system or a problem
SPI-4: Design a system to meet specifications
SPI-5: Process data
SPI-6: Communicate an analysis, a scientific approach
T3: Contribute to sustainable development and construction
T4: Manage (assess, maintain, rehabilitate) existing structures
SHS3: Interact with others, work as part of a team

* Targeted abilities :
_ Evaluate the suitability of materials in terms of their LCA (C1, C2, T3) ;
_ Know how to choose a material according to its properties (SPI-4, C1, C2, T3);
_ be able to carry out a life-cycle analysis of a building (SPI-5, T3);
_ be able to reflect objectively on the quality and environmental impact of buildings (SPI-1, SPI-4, SPI-5, T3);
_ Be able to write a critical report as part of a team on the environmental assessment of a building (SPI-6, SHS3).

* Targeted knowledge :
_ Know the principles, methodology and applications of life cycle assessment (LCA);
_ Identify methodological issues specific to the application of LCA to materials;
_ Know the LCA profiles of the main GC materials.

CONTENT

The aim of this course is to approach environmental quality through the interpretation of LCAs (Life Cycle Assessment) of materials and/or buildings. The approach begins with a study of the environmental impact of materials (FDES/DEP), followed by a study of the building as a whole.

Generally speaking, the aim of this course is to :

- Learn to understand and find the key information in the FDES;
- Use ESDS configurators (BETie, SAVE, de-bois de France) to create a complete environmental data sheet for a specific product (concrete, steel, wood, etc.);
- Learn how to evaluate products and materials in terms of their environmental impact;
- Use ClimaWin software to define a basic building;
- Assess the impact of a renovation on an initial building.

BIBLIOGRAPHY

L'analyse du cycle de vie dans le bâtiment, A. LEBERT, J-L. CHEVALIER, CSTB, 2018.

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Decision Support - 2

IDENTIFICATION

CODE : GCU-4-S1-EC-AD
ECTS : 2.00

HOURS

Cours :	10h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	31.5h
Travail personnel :	20h
Total :	51.5h

ASSESMENT METHOD

1 x 2h

TEACHING AIDS

pdf and paper document
excel files for projects

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-4-S1-UE-DD-AD and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)(level 2);
A2- Operate a model of a real or virtual system (level 2);
A3- Implement an experimental approach (level 2);
A4- Design a system that meets specifications (level 2);
A5- Process data (level 2).

Competences in Humanities, Documentation and Physical and Sports Education:
B5- Act responsibly in a complex world (level 1).

Competences specific to the specialty:
C24- Contribute to organize construction sites, to the compliance of safety rules and deadlines (level 2);
C25- Contribute to sustainable urban developments and sustainable construction (level 2);
C26- Manage assets (assessment, maintenance, rehabilitation) (level 2).

Allows the student to work and be evaluated on the following knowledge:
- Life Cycle Assesment and decision support;
- Probabilistic models et statistical tools for asset management;
- Project scheduling methods;
- Stochastic simulation: Monte Carlo method ;
- guide to the expression of uncertainty in measurement (GUM)

Allows the student to work and be evaluated on the following abilities:
- implement LCA on a simple case study;
- analyse failure factors and choose a rehabilitation date;
- plan a project;
- use Monte Carlo simulations to study a stochastic problem;
- evaluate uncertainties;

CONTENT

- LCA - Life cycle assessment ;
- Probabilistic models and statistical methods for failure modelling and asset management ;
- Project scheduling (PERT, Gantt, random durations, resource-constrained project scheduling).
- Stochastic simulation: Monte Carlo method ;
- guide to the expression of uncertainty in measurement (GUM)

BIBLIOGRAPHY

IEC - International Electrotechnical Commission (2009) ISO/IEC Guide 98-1:2009 Incertitude de mesure -- Partie 1: Introduction à l'expression de l'incertitude de mesure
FELDMAN, R. & VALDEZ-FLORES, C. (1996) Applied probability and stochastic processes. Boston : PWS- ITP.
KAUFMANN, A. (1968) Méthodes et modèles de la recherche opérationnelle (tomes 1 et 2) Dunod,
LAURENCELLE, L. (2001) Hasard, nombres aléatoires et méthode Monte Carlo. Presses de l'Université du Québec.
LEFEBVRE, M. (2005) Processus stochastiques appliqués. Montréal (Canada) : Presses Internationales Polytechnique.
SELVIN, S. (1995) Practical Biostatistical Methods. Belmont : Duxbury Press.
ZWILGELSTEIN (1996) La maintenance basée sur la fiabilité. Paris : Hermes.
LEBERT A., CHEVALIER J-L. (2018) L'analyse du cycle de vie dans le bâtiment - Comprendre et réaliser une ACV, BÂTIR LE DÉVELOPPEMENT DURABLE, CSTB.
SAADA-SBEIH M., JOLLIET-GAVIN N., JOLLIET O., CRETTAZ P., SHAKED S. (2017) Analyse du cycle de vie - Comprendre et réaliser un écobilan, GÉRER L'ENVIRONNEMENT, PPUR Presses Polytechniques.

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Gestion de projets / Project management

IDENTIFICATION

CODE : GCU-4-S2-EC-GESP
ECTS : 1.00

HOURS

Cours :	10h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

MCQ and project presentation

TEACHING AIDS

Documents available on mooddle

TEACHING LANGUAGE

French

CONTACT

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M. GEORGIN Jean-Francois :
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AIMS

This module is part of the course unit GCU-4-S2-UE-MEP and contributes to:

School skills in engineering sciences:
A1- Analyze a real or virtual system (or problem) (level 2) ;
A4- Design a system to meet specifications (level 2);
A5- Process data (level 2);
A6- Communicate a scientific analysis or approach, using situations appropriate to the specialty (level 2);

School skills in humanities, documentation and physical and sports education :
B2- Work, learn and develop independently (level 3);
B3- Interact with others, work as part of a team (level 3) ;
B4- Demonstrate creativity, innovate, undertake (level 1);
B5- Act responsibly in a complex world (level 2);

CONTENT

- Defining a project
- Defining project management
- Associating the launch phase with the implementation of project framework elements
- Define financial management and associated key concepts
- Detail study management and construction management
- Differentiate between functional and hierarchical management
- Define and analyze risks and opportunities
- Define the stages involved in closing a project

BIBLIOGRAPHY

PRE-REQUISITES

None

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Construction economy and scheduling

IDENTIFICATION

CODE : GCU-4-S2-EC-ECO
ECTS : 1

HOURS

Cours :	4h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	16h
Travail personnel :	20h
Total :	36h

ASSESMENT METHOD

role-playing games

TEACHING AIDS

Documents available on moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

This CA is part of the teaching unit GCU-4-S1-UE-MEP and contributes to:

Skills school of science for the engineer:
A1- Analyze a real or virtual system (or problem) (level 2);
A4- Designing a system that meets specifications (level 2);
A5- Data processing (level 2);
A6- Communicate an analysis or a scientific approach with scenarios adapted to the specialty (level 2);

School of Humanities, Documentation and Physical and Sports Education:
B2- Working, learning and developing independently (level 3);
B3- Interact with others, work as a team (level 3);
B4- Creativity, innovation, entrepreneurship (level 1);
B5- Act responsibly in a complex world (level 2);
B6- Be located, work, develop in a company, a socio-productive organization (level 1);

School specific skills:

Allowing the student to work and be assessed on the following knowledge:
- Knowledge of the actors and phases of a building construction and transport project
- Estimated cost of construction and transportation project
- Multi-criteria analysis (including economics) of business offers for a building and transport project
- BIM applied in a transport project
- Knowledge of major phases

Allowing the student to work and be assessed on the following abilities:
- Synthesis for analysis (aggregate a multitude of information in a document limited in size)
- Oral restitution, clarity and understanding of each person's role in the building design and transport project process
- Understanding the client's needs by directing their work effectively in a limited time (prioritize)

Critical thinking
- Observation of a general question and ability to refocus exchanges on the essential
- Written restitution, clarity (in particular on spreadsheet renderings with issues of synthesis once again)

CONTENT

- The positioning of the economist and the OPC (Ordonnancement Pilotage et Coordination) in the design and implementation of a building and transport project
- The contribution of the economist according to project phases (and related regulations)
- Techniques for estimating the cost of work - example on a simple building
- The challenges of a precise working methodology on the reliability of results and communication with the client
- The challenges of defining the construction planning from the study phase (on the project's economy in particular)
- Multi-criteria analysis techniques on a building with focus on the economic criterion with a transport project - with a role play of restitution of work for corrected common
- The application of the Pareto law (80-20) in economics (and more generally in all fields)
- Observation exercises:

*Comparison of plans to qualitatively identify economic vigilance points
*Conflicts on transport projects on a 3 D model

BIBLIOGRAPHY

PRE-REQUISITES

Level of French B2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sécurité-Certification-Qualité-BIM / Safety-Certification-Quality-BIM

IDENTIFICATION

CODE : GCU-4-S2-EC-CONF
ECTS : 1.00

HOURS

Cours :	8h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	8h
Travail personnel :	10h
Total :	18h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

This module is part of the course unit GCU-4-S2-UE-MEP and contributes to:

CONTENT

Lecture 1: Quality Management in Construction
- Definition and challenges of quality in construction
- Quality standards and frameworks (ISO 9001, NF Habitat, HQE)
- Quality control techniques and management tools
- Case studies and lessons learned

Lecture 2: Certifications and Labels in Construction
- Overview of environmental and technical certifications (HQE, BREEAM, LEED, Passivhaus)
- Criteria and certification process
- Impact of certifications on building valuation
- Practical examples and real-world cases

Lecture 3: Safety on Construction Sites
- Regulations and legal obligations regarding safety (Health and Safety Coordination – SPS, Construction and Housing Code – CCH)
- Stakeholders and responsibilities in health and safety protection
- Risk analysis methods and tools (Occupational Risk Assessment Document – DUER, Prevention Plans)
- Accident management and professional risk prevention

Lecture 4: Introduction and Practices of BIM
- Definition and principles of Building Information Modeling
- Digital tools and collaborative BIM platforms
- BIM project management: roles, methods, and collaborative processes
- Case studies and feedback from real BIM projects

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Droit de la construction / Building law

IDENTIFICATION

CODE : GCU-4-S2-EC-DR
ECTS : 1.00

HOURS

Cours :	24h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	26h
Travail personnel :	20h
Total :	46h

ASSESMENT METHOD

Written exams

TEACHING AIDS

Copies of courses

TEACHING LANGUAGE

French

CONTACT

M. GEORGIN Jean-Francois :
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AIMS

This CE is part of teaching unit GCU-4-S1-UE-MEP and contributes to :

School skills in humanities, documentation and physical and sports education:
B6- Situating oneself, working and developing in a company or socio-productive organization (level 1)

School skills specific to the specialty :
C23- Contribute to multidisciplinary building design (level 1);
C24- Contribute to the organization of construction sites, compliance with safety regulations, control of deadlines, etc. (level 1).

By enabling the student to work on and be assessed on the following knowledge :
- those involved in the act of building ;
- contractualization methods (general principles of civil liability law and property law).

By enabling students to work and be assessed on the following skills:
- identify the role of each player according to the type of contractual arrangement chosen, and for each arrangement, measure the functional links between the various players.

CONTENT

Status of Construction Professionals:
- Historical evolution of construction practices and emergence of key stakeholders (based on techniques used and materials)
- The Project Owner (Client): Status and Obligations
- Project Owner's Assistants (Delegated Project Management, Operation Management, Technical Assistance—AMO)
- Safety Management Team (Technical Controller and Health and Safety Coordinator)
- Project Management Team (Architects, Engineers, Consultants)
- Construction Execution Team (Contractors and their modes of intervention)

Legal Framework for Public Procurement in Construction: Tendering, Execution, and Disputes:
- General Framework and Stakeholders in Public Procurement
- Public Procurement Procedures (Formal Procedures, Adapted Procedures)
- Execution of Public Procurement Contracts
- Obligations and Liabilities of Construction Professionals
- Disputes in Public Procurement Contracts

BIBLIOGRAPHY

- Coordination de sécurité et de protection de la santé (J. Clément et D.Couffignal, 2ème édition, Le Moniteur 2001)
- Contrôle technique de la construction (J. Clément et D.Couffignal, AFNOR 2001)
- Conduire son chantier (J. Armand, Y. Raffestin et D.Couffignal, 8ème édition, Le Moniteur 2007)

PRE-REQUISITES

None

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Discovery internship

IDENTIFICATION

CODE : GCU-4-S2-EC-STGF
ECTS : 0.00

HOURS

Cours :	0h
TD :	2h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	2h
Travail personnel :	0h
Total :	2h

ASSESMENT METHOD

The internship lasts between 4 and 8 weeks (minimum 4 consecutive weeks) and is designed to introduce students to the engineering profession. It must be carried out in a company or organization whose main sector of activity is civil engineering and urban planning.

The internship is assessed in several ways:
- the student's ability to find an internship related to the GCU course within the allotted timeframe
- the assessment based on the evaluation form provided by the company
- the quality of the compulsory summary report and compliance with the report deadline.

TEACHING AIDS

INSA Lyon/GCU, "Acquis-de-l-apprentissage-visés-par-la-formation-GCU." Document available on the digital space.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

SKILLS :
This CE is part of the Stage 3GCU teaching unit and contributes to the following competencies
following competencies:
A1 Analyze a real or virtual system (or problem) (level 2)
A3 Implement an experimental approach (level 2)
A4 Design a system to meet specifications (level 2)
A5 Process data (level 2)
A6 Communicate a scientific analysis or approach, using real-life situations adapted to their specialty (level 2)
B1 Know oneself, manage oneself physically and mentally (level 2)
B2 Work, learn and develop independently (level 2)
B3 Interact with others, work as part of a team (level 2)
B4 Be creative, innovative, enterprising (level 2)
B5 Act responsibly in a complex world (level 2)
B6 Situate oneself, work and evolve in a company or socio-productive organization (level 2)

CONTENT

Internship lasting 4 to 8 weeks.

BIBLIOGRAPHY

INSA Lyon/GCU, "Acquis-de-l-apprentissage-visés-par-la-formation-GCU." Document available on the digital space.

PRE-REQUISITES

GCU-4-S1 and GCU-4-S2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Building design: multidisciplinary approach

IDENTIFICATION

CODE : GCU-4-S2-EC-M8
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Ongoing evaluation (33%)
Oral defence of the project (33%)
Written exam (33%)

TEACHING AIDS

MATLAB / Octave
Photocopies

TEACHING LANGUAGE

English

CONTACT

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AIMS

GCU-4-S2-EC-M8 incompatible with M7, M9 et M11 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (Level 3)
A2- Operate a model of a real or virtual system (Level 3)
A6- Communicate a scientific analysis or approach (Level 3)

Competences in Humanities, Documentation and Physical and Sports Education:
B1- Know oneself; manage mental and physical fitness (Level 1)
B2- Work, learn, progress autonomously (Level 3)
B3- Interact with others, work as a team (Level 3)
B4- Demonstrate creativity, innovate and undertake (Level 3)
B5- Act responsibly in a complex world (Level 2)

Competences specific to the specialty:
C1- Perform, interpret a geological profile, interpret a map or remote sensing result, identify a geological horizon
C6- Design, dimension, model or verify foundation and retaining systems;
C7- Building structure (design, dimension and control a ...)
C15- Design and control good technical solutions for buildings in terms of thermal, airflow, acoustics
C17- Designing and sizing networks and structures based on hydrologic and hydraulic approaches for urban planning, buildings and civil engineering infrastructures
C23- Contribute to a pluri-disciplinary design process of buildings

CONTENT

Design a building by using fundamental principles.
Draw plans at scale 1/200.
Develop the ability to implement design methods into algorithms.
Optimise solutions.
Collaborate in order to solve complex problems.

Programme of professional specialities
Geotechnics
- Assess of a superficial foundation system by elastic finite element method (MATLAB Implementation).
- Assess the bearing capacity of the foundation by an elasto-plastic method: a standard elasto-plastic constitutive model using Drücker-Prager criterion has to be developed and implemented in an existing finite element code.

Structures
- Design of a beam-and-post structure.
- Develop of a Finite Element model based on Navier-Bernoulli beam elements (under MATLAB) in 2D and linear elasticity.
- Assess the internal forces and the maximum displacements and define the cross-sections dimension according to the considered material.
- Analyse the effect on the design of different loading scenarios (dead weight, wind, operating load, etc.).

Energy
- Calculate the thermal load (MATLAB implementation)
- Size the heating and air conditioning systems
- Estimate the thermal performance (MATLAB implementation)
- Optimise the thermal behaviour of the building

Hydraulics - pressurized flows
Design and size a water distribution network.
Compute flow rate distribution in a water supply network with respect of water demand and operating pressures (MATLAB implementation).
Propose a reliable technical option for a sustainable water management at the building scale (water harvesting, reuse for various purposes, etc.).

BIBLIOGRAPHY

1. H. Moore (2011) MATLAB for Engineers, Pearson Education
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3. C. Ghiaus (2014) Linear algebra solution to psychometric analysis of air-conditioning systems, Energy (24), p. 555-566
4. Amiroudine, S., & Battaglia, J. L. (2017). Mécanique des fluides-3e éd.: Cours, 70 exercices corrigés. Dunod.

5. Comolet, R. (2006). Mécanique expérimentale des fluides. vol 2, 4e éd. Dunod.
6. Batoz J-. L. et Gouri Ghatt., Modélisation des structures par éléments finis. Hermès, 1990
7. Cazenaze, M. Méthode des éléments finis - Approche pratique en mécanique des structures
Dunod, 2010
8. Zienkiewicz, O. & Taylor, R. The finite element method for solid and structural mechanics 1967
9. Philipponnat G., Hubert B., (2016). Fondations et ouvrages en terre, Eyrolles
10. Prunier F., (2017). Description du comportement des géomatériaux, cours INSA Lyon

PRE-REQUISITES

Documentary research (PC-S1-DOC)

Algorithms and computer programming (PC-S1-IF)
Algorithms and computer programming (PC-S2-IF)
Algorithms and computer programming (PC-S3-IF)
Algorithms and computer programming (PC-S4-IF)

Numerical toolboxes (PC-S1-ON)
Mathematics for applied sciences (PC-S1-OM)
Mathematics for applied sciences (PC-S1-OM-P)

Numerical toolboxes (GCU-3-S1-EC-ONUM)
Identification of soils and hydraulics (GCU-3-S1-EC-IMRS et GCU-3-S1-EC-GEOL)
Soil mechanics (GCU-3-S2-EC-MS)

Structural analysis methods (GCU-3-S2-EC-MAS-1 et GCU-3-S2-EC-MAS-2)
Initiation to structural analysis (GCU-3-S1-EC-IAS1 et GCU-3-S1-EC-IAS2)
Continuum Solid Mechanics (GCU-3-S1-EC-MMC)

Thermodynamics (PC-S2-TH)
Heat transfer (GCU-3-S1-EC-TC)
Thermo-aerodynamics behaviour of buildings (GCU-3-S1-EC-THB)
Air conditioning (GCU-3-S2-EC-CLI)

Fluid mechanics (GCU-3-S2-EC-MF)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Diagnosis and repair of structures

IDENTIFICATION

CODE : GCU-4-S2-EC-M7
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Reports
Oral Defence

TEACHING AIDS

Lessons
Textbook of pratical works
Project

TEACHING LANGUAGE

French

CONTACT

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AIMS

GCU-4-S2-EC-M7 incompatible with M8, M9 et M11 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-MOD-OPT and contributes:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A3- Implement an experimental approach (level 2)
A4- Designing a system that meets a specification (level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B3- Interact with others, work as a team (level 1)

Competences specific to the specialty:
C7- Building structure (design, dimension and control a¿) (level 2)
C8- Civil Engineering Structures (design, dimension and control a ...) (level 2)
C9- Highway and rail infrastructure (design, dimension and control a ...) (level 2)
C13- Assess the structural health, define mandatory actions (level 2)
C14- Define rehabilitation operations of a civil engineering structure (level 2)
C26- Manage assets (assessment, maintenance, rehabilitation) (level 2)

Allows the student to work and be evaluated on the following knowledge:
Functioning of building components
Causes of construction materials pathologies
Experimental tests
Causes and effects of the dysfunction of the building constructions and bridges
Test facilities and investigation means to realize according to the pathologies

Allows the student to work and be evaluated on the following abilities:
To design of strutural components of a common building
To choose and to implement the repair and retrofitting techniques the more suitable in considering the technical and economic aspects
To realize material characterisation test (durability)

CONTENT

Analyse and design of a common building: bracing, floor slab, statically indeterminate beam, columns, foundation. Case study on a reinforced concrete building.
Pathologies of concrete structures (steel corrosion, carbonation ¿) and related diagnostic methods.
Practical works on the material characterisation and the site investigation methods.
Inspection and repair techniques for different type of bridges (concrete, steel, masonry, cable- stayed).

BIBLIOGRAPHY

Eurocode 1 - Partie 2 : Charges sur les Ponts Routes.
Fascicule 61 - Titre II : Conception, calcul et épreuves des ouvrages d'art.
Eurocode 2 : Calcul des structures en béton - Partie 1-1 : Règles générales et règles pour les bâtiments.
Eurocode 3 : Calcul des structures en acier.
Eurocode 4 : Calcul des structures mixtes acier-béton.
Thonier M. : Le projet de béton armé. 5ème édition. SEBTP. 2005

PRE-REQUISITES

GCU-3-S1-EC-IAS-1
GCU-3-S1-EC-IAS-2
GCU-3-S1-EC-MA
GCU-3-S1-EC-MMC
GCU-3-S2-EC-BA
GCU-3-S2-EC-MAS-1
GCU-3-S2-EC-MAS-2
GCU-4-S1-EC-BP
GCU-4-S1-EC-EAS1
GCU-4-S1-EC-EAS2
GCU-4-S1-EC-GMM1

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Geotechnical Structures for Climate Change

IDENTIFICATION

CODE : GCU-4-S2-EC-M11
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Project report
Written Exam

TEACHING AIDS

Copy of the courses

TEACHING LANGUAGE

French

CONTACT

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AIMS

GCU-4-S2-EC-M11 incompatible with M7, M8 et M9 (courses in the same time slots)

This education is under the Education Unit GCU-4-S2-UE-mod-opt and contributes to the acquisition of the following skills:
Skills schools in engineering sciences
A1- Analyze a real or virtual system (or problem)
A4- Designing a system that meets a specification
Skills schools in humanity, documentation and physical education and sports:
B2- Work, learn, evolve autonomously
B3- Interact with others, work as a team
Skills specific to the specialty:
C6- Design, dimension, model or verify foundation and retaining systems;
C4- Evaluate a risk of hydraulic instability of soils (uplift, rupture, ...);
By allowing the student to work and be evaluated on the following knowledge:
- the equilibrium limite of active and passive forces
- the behavior of foundation and retaining systems
- the calculation methods for the research for the most unfavorable fracture mechanism;
- the bases for calculation of shallow and deep foundations;
- the calculation methods according to Eurocodes
- the general knowledge on the specific fields of geotechnics
- the knowledge of the main software used in geotechnical design office
By allowing the student to work and be evaluated on the following abilities:
- analyze, design and model a flexible or rigid wall, a retaining weight wall or cantilever wall;
- analyze, design and model the different types of shallow and deep foundations according to soil behaviour and superstructure constraints;
- to be able to choose the appropriate techniques for geotechnical construction.

In addition, contributions of geotechnics to "sustainable construction" aspects. Environmental geotechnics: soil improvement, risks related to the swelling/shrinking of clays, risks of soil pollution, surface and deep storage. Reasonable extraction of resources, notions of recycling, beneficial-uses of bio-sourced geomaterials, co-valorisation, multiple aspects (scientific, technical, ethical, political, actors...). Dimensioning by observational method which optimises the use of materials and energy resources.

CONTENT

Yield design. Active and passive equilibrium states: calculation of limite equilibrium and soil structure interaction
Analytical and numerical design according to Eurocodes for retaining structures
Analytical and numerical design according to the Eurocodes for shallow and deep foundations.

Openness to specific areas of geotechnics and the contribution of geotechnics to sustainable construction aspects:
- Soil improvement
- Earthquake engineering
- Underground works
- Geosynthetics and auscultation
- Environmental geotechnics (soil remediation, waste management)
- valorization of the excavated soils during tunnel digging, valorization of terrestrial / fluvial / marine sediments according to the notions of recycling, reuse and reuse and also the introduction of co-valorization which is the material recovery of several wastes.

2 major supervised projects with reporting are counted as Seminars.

BIBLIOGRAPHY

- Cordary D. (1994) Mécanique des sols, Lavoisier - Tec & Doc
- Hicher P.Y., Shao J.-F. (2002) Elastoplasticité des sols et des roches Hermès Sciences.
- Nova R. (2005) Fondements de la mécanique des sols, Lavoisier Hermès Sciences
- Philipponnat G, Hubert B. (2008) Fondations et ouvrages en terre, Eyrolles, 7ème édition.
- Plumelle C. (sous la direction) (2012) Théorie et pratique de la géotechnique. La

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Domaine Scientifique de la DOUA
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Energy management in Buildings

IDENTIFICATION

CODE : GCU-4-S2-EC-M9
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

- Written report: on a "real" case, renovation of one of the campus buildings
- oral defence of the project: critical analysis of the solutions adopted for renovation

TEACHING AIDS

- "Design Builder" environment and its tutorials
-Course material given during the lessons + Digital documents available
- current standards and regulations

TEACHING LANGUAGE

English

CONTACT

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AIMS

GCU-4-S2-EC-M9 incompatible with M7, M8 et M11 (courses in the same time slots)

The main goal of the course is to develop the right reflexes and attitude towards the use of energy in buildings, in particular by worrying about all the environmental consequences caused by the choices made. Furthermore, the intention is to develop a multidisciplinary vision for energy use in new and existing buildings.

This sheet falls within the Course Unit "Optionnal module" : GCU-4-S2-UE-mod-opt and contributes to:

General Skills in Science for the Engineer:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 3)
A6- Communicate a scientific analysis or approach with adapted situational conditions to the
specialty (level 2)

Skills specific to the speciality domain :
C15- Design and control good technical solutions for buildings in terms of thermal, airflow,acoustics (level 3)
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance (level 2)
C25- Contribute to sustainable planning and sustainable construction (level 1)

By mobilizing the following skills :
B3- Interact with others, work as a team
B4- FShow creativity, innovate and undertake
B5- Act responsibly in a complex world

By allowing the student to work and be assessed on the following knowledge:
- knowledges developed in the courses GCU-S-TC (Heat Transfers),GCU-S5-THB (Heat and mass transfers in buildings),GCU-S6-AC (Acoustic), GCU-S6-CLI (HVAC)

By allowing the student to work and be assessed on the following abilities:
- propose appropriate solutions with an holistic and multidisciplinary vision that offers a comfortable interior "climate" (lighting, acoustics, heat, air quality, energy supply and technical installations, regulation, management, operation and maintenance¿) while being economically sound,
- implement design methods using simulation tools,
- take a critical look at dimensioning methods, simulation tools, regulations and standards,
- analyze simulation results and return results with a critical perspective,
- propose innovative and sustainable solutions.

CONTENT

- additional courses concerning: lighting, acoustics, heat, air quality, energy supply and technical installations, regulation, management, operation and maintenance¿
- awareness of modeling assumptions in commonly used codes
- learning "Design Builder" environment(in support of design or renovation of building and economic assessment of technical solutions)

BIBLIOGRAPHY

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- http://www.batisim.net/aide/index.html?_introducing_designbuilder.htm
- https://energyplus.net/support
- https://www.energieplus-lesite.be/index.php?id=2
- Énergétique des bâtiments et simulation thermique,Eyrolles,2015

PRE-REQUISITES

- knowledges developed in the courses GCU-3-S1-EC-TC (Heat Transfers),GCU-3-S1-EC-THB (Heat and mass transfers in buildings),GCU-3-S2-EC-AC (Acoustic), GCU-3-

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Domaine Scientifique de la DOUA
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Innovative Materials for Sustainable Construction

IDENTIFICATION

CODE : GCU-4-S2-EC-M16
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Report and oral presentation of the project

TEACHING AIDS

Duplicated documents
On-line documents

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-M16 incompatible with M2, M12 et M15 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)(level 2)
A3- Implement an experimental approach (level 1)
A4- Design a system that meets specifications (level 2)
A5- Processing data (level 1)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 1)
B3- Interact with others, work as a team (level 2)
B4- Demonstrate creativity, innovate and undertake (level 2)
B5- Act responsibly in a complex world (level 2)

Competences specific to the specialty:
C8- Civil Engineering Structures (design, dimension and control a ...) (level 2)
C12-Assess several building methods (level 2)
C25- Contribute to sustainable urban developments and sustainable construction (level 2)

Allows the student to work and be evaluated on the following knowledge:

_ Principle of a LCA: Life cycle analysis
_ Mechanical, hydric, thermal properties of alternative materials
_ Principle of stabilization / consolidation of alternative binders
_ Pathology mechanism of earthen construction
_ Standard for new materials

Allows the student to work and be evaluated on the following abilities:

_ Answering a set of specifications
_ Develop low environmental impact materials
_ Select materials with respect to environmental specifications
_ Implement a LCA
_ Act in an environmental approach

CONTENT

Faced with the challenges of global warming, the construction industry has a key role to play. Indeed, it is one of the main contributors to this effect because of the building materials currently used and the energy consumption during the life of the buildings. It is therefore necessary to develop low environmental impact building materials with thermal and hygrothermal efficiency to reduce energy requirements during the life cycle of the building. This CU allows the student to acquire the theoretical and scientific concepts on the different families of Materials for sustainable construction that will provide the necessary basis to respond to a call for projects with environmental specifications. The course will address the emergence and development of new sustainable materials construction sectors. This module will be treated in the form of lectures, experimental conferences, a MOOC and a project during which the students will devote themselves to the search for a solution that meets a predefined specification from bibliographic studies, experimental studies and characterization of materials.

Translated with www.DeepL.com/Translator (free version)

A. Series of seminars (interactive lectures) (30h)

I. Introduction and presentation of the projects
II. Sustainable materials
III. Presentation and comparison of different material from a matter/materials approach
IV. Design of experiments
V. Thermal and hydric properties of materials and buildings
VI. Control of the use of new materials in construction
VII. Market / sectors / issues

B. Answer to a call for projects concerning sustainable building (40h)

The call for projects that will be proposed to students was proposed by the « Région Rhône-Alpes » and concerns social housing using wood and earth. It is therefore in the framework of sustainable materials for construction.
The project takes place all along the course for a total duration of 46h. The students will work by groups of 3 to 4. The purpose is to join their different knowledge and cultures on

materials, construction and environment. The evaluation of the project will be done by means of a report and an oral presentation.

BIBLIOGRAPHY

(a) Bâtir en terre, du grain de sable à l'architecture, R. Anger, L. Fontaine, Belin, 2009.
(b) L'isolation thermique écologique, Conception, matériaux, mise en uvre, Jean-Pierre Oliva, Habitat Techniques De Pro, Terre Vivante, 2010.

PRE-REQUISITES

None

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Projets urbains

IDENTIFICATION

CODE : GCU-4-S2-EC-M2
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

- Report (15 p.)
- 1 oral prestentation (15 min)
- Investigation (social science methodology)

TEACHING AIDS

- Scientific papers
- Tecnical documents about the urban project

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-2 incompatible with M12, M15 et M16 (courses in the same time slots)

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 3)
A3- Implement an experimental approach (level 3)
A5- Process data (level 3)
A6- Communicate a scientific analysis or approach (level 3)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 3)
B3- Interact with others, work as a team (level 3)
B4- Demonstrate creativity, innovate and undertake (level 3)
B5- Act responsibly in a complex world (level 3)

Competences specific to the specialty:
C20- Analyse an urban context (technical, political and social patterns at different scales) (level 3)
C21- Achieve a global urban diagnosis (level 3)
C22- Design and lead a town-planning project (level 3)
C25- Contribute to sustainable urban developments and sustainable construction (level 3)

Mobilizes the following competences
Reading and critic analysis, debates managing (all in french) about urban thematics.
Reflexive capacity in order to analyse the social and environmental responsability of the engineer.

Allows the student to work and be evaluated on the following knowledge:
Knowledge of methodology of the urban planning and urban analysis
Knowledge of methodology in social sciences (investigation, interviews, observation)
Knowledge in the field of housing and urban planning, especially in french context

Allows the student to work and be evaluated on the following abilities:
Abilities to connect theoric knowledge and pratical expertise about cities
Ability to work in group and to be autonomous
Development of a general culture of the urban fact
Ability to take a stance in debates about urban questions

CONTENT

- Introduction to urban analysis. Realisation of a study, based on a professionnal order
- Analysis of a urban neighbourhood in order to study the social and environnemental impact of the engineer
- Seminar and debates about urban policies
- Introduction to urbanism tools (GIS, draw & representation, Inkscape)
- Visit of urban project, meeting with professionnals

BIBLIOGRAPHY

DRIANT Jean-Claude, 2015, Les politiques du logement en France, Paris, France, La Documentation française.
GINTRAC Cécile et GIROUD Matthieu, 2014, Villes contestées. Pour une géographie critique de l'urbain, Paris, Les prairies ordinaires.
MERLIN Pierre, 2015, L'urbanisme, Paris, France, PUF.
PANERAI Philippe, DEMORGON Marcelle, et DEPAULE Jean-Charles, 2012, Analyse urbaine, Marseille, France, Ed. Parenthèses.
TRIBILLON Jean-François, 2009, L'urbanisme, Paris, France, La Découverte.

PRE-REQUISITES

- GCU-4-S1-EC-UR ; GCU-3-S1-EC-UR : Introduction classes about urban planning and social sciences.
- Good level in french (speak, read, write)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

BIM: Tools and working methods

IDENTIFICATION

CODE : GCU-4-S2-EC-M15
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

- Written report: on a "real" case, renovation of one of the campus buildings
- oral defence of the project: critical analysis of the solutions adopted for renovation

TEACHING AIDS

- https://logiciels.cstb.fr/bim-et-maquette-numerique/
- https://logiciels.cstb.fr/sante-confort/
- https://logiciels.cstb.fr/batiments-et-villes-durables/

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-M15 incompatible with M2, M12 et M16 (courses in the same time slots)

" It is difficult to find a definition of the BIM accepted by all. " The BIM is mainly working methods and a 3 D parametric numerical model that contains intelligent and structured data. The BIM is the sharing of reliable information throughout the life of a building or infrastructure, from conception to demolition. The numerical model for it is a digital representation of the physical and functional characteristics of this building or infrastructure.
The purpose of this module is to familiarize itself with the BIM and experience it on a concrete example of renovation of a campus building.

This sheet falls within the Course Unit "Optionnal module" : GCU-4-S2-UE-mod-opt and contributes to:

General Skills in Science for the Engineer:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 3)
A5- Processing data

Skills specific to the speciality domain :
C15- Design and control good technical solutions for buildings in terms of thermal, airflow,acoustics (level 3)
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance (level 2)
C23- Contribute to a pluri-disciplinary design process of buildings (level 2)
C25- Contribute to sustainable planning and sustainable construction (level 1)

By mobilizing the following skills :
B3- Interact with others, work as a team
B4- FShow creativity, innovate and undertake
B5- Act responsibly in a complex world
B6- Situate oneself, work, evolve within a company or a socio-productive organization

By allowing the student to work and be assessed on the following knowledge:
- knowledges developed in the courses GCU-S-TC (Heat Transfers),GCU-S5-THB (Heat and
mass transfers in buildings),GCU-S6-AC (Acoustic), GCU-S6-CLI (HVAC),

By allowing the student to work and be assessed on the following abilities:
- propose appropriate solutions with an holistic and multidisciplinary vision while being economically sound,
- implement design methods using simulation tools,
- propose innovative and sustainable solutions.

CONTENT

- Understand what Building Information Modeling (BIM) is
- Evaluate through a project the collaborative work interests possible through the BIM
- The BIM for Technical Performance Assessment, the BIM for Maintenance, BIM in the design phase and phase of completion of work, the buildings stock Management Phase

BIBLIOGRAPHY

- http://www.objectif-bim.com/index.php/bim-maquette-numerique/le-bim-en-bref/la-definition-du-bim
- https://formations.cstb.fr/catalogue-formations/bim-et-maquette-numerique/
- Laurent Joblot, Thomas Paviot, Dominique Deneux, Samir Lamouri. Analyse du BIM appliqué à
la rénovation. 11th International Conference on Modeling, Optimization and SIMulation (MOSIM
2016), Aug 2016, Montréal, Canada.
- - Conrad Boton,Daniel Forgues,Gilles Halin,Université de Lorraine, NancyLes enjeux liés à l'intégration de l'approche BIM de modélisation des données du bâtiment à l'enseignement universitaire : cas d'une école d'ingénierie,2017, International Journal of

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MEG, Modeling Environmental Geostructures

IDENTIFICATION

CODE : GCU-4-S2-EC-M12
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	61h
Travail personnel :	80h
Total :	141h

ASSESMENT METHOD

- Individual test
- Project report and (or) oral presentation

TEACHING AIDS

- Lesson slideshow
- Plaxis software
- UDEC software
- GDM suite (BRGM software)

TEACHING LANGUAGE

English

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AIMS

GCU-4-S2-EC-M12 incompatible with M2, M15 et M16 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 3) ;
A2- Operate a model of a real or virtual system (level 3) ;
A4- Design a system that meets specifications (level 3) ;
A5- Process data (level 3) ;
A6- Communicate a scientific analysis or approach (level 3);

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 3) ;
B3- Interact with others, work as a team (level 2) ;
B4- Demonstrate creativity, innovate and undertake (level 2) ;

Competences specific to the specialty:
C1- Perform, interpret a geological section, interpret a map or remote sensing result, identify a geological horizon (level 3) ;
C2- Perform and / or interpret geotechnical laboratory tests for classification and constitutive modelling (level 2) ;
C3- Assess a slope failure risk under various stresses (level 2) ;
C4- Assess a risk of hydraulic instability of the soil (uplift, failure, ...)(level 2) ;

Mobilizes the following competences
C6- Design, modelize or verify foundation and retaining wall systems (level 2) ;

Allows the student to work and be evaluated on the following knowledge:
- Finite elements methods in geomechanics ;
- Geomaterials constitutive modeling (elasto-plasticity theory) ;
- Discrete element method, mechanics of granular media ;
- Structural geology, cartography, geological section ;

Allows the student to work and be evaluated on the following abilities:
- Exploit geological data in order to build a geological model to be implemented in a numerical code ;
- Design a geomechnical structure using a proper numerical tool ;
- Analyze and interpret results from a numerical code ;
- To know and apprehend a numerical model with respect to the reality of the terrain where the structure is located.

CONTENT

- Reminders in linear algebra (matrices calculations)
- Reminders in continuum mechanics (stress-strain tensors)
- Realization of a geological section in connection with the studied engineering structures.
- Mechanical behavior of soils (elasticity and elasto-plasticity theory)
- Modelling geotechnical structures (foundations, retaining walls, underground structures)

BIBLIOGRAPHY

PRE-REQUISITES

Equivalent of
- GCU-3-S1-EC-IMRS, GCU-3-S1-EC-GEOL et GCU-3-S2-EC-MS : fundamentals of soil mechanics and geotechnics
- GCU-4-S1-EC-ISS : fundamentals of engineering geology
- GCU-3-S1-EC-IAS1, GCU-3-S1-EC-IAS-2 : fundamentals of beam theory and mechanics of materials
- GCU-3-S1-EC-MMC : fundamentals of continuum mechanics
- GCU-3-S2-EC-MAS-2 : fundamentals of finite elements methods

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Adapting cities for climate change: Understanding to enable sustainable designs

IDENTIFICATION

CODE : GCU-4-S2-EC-M10
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

- Written report: on a "real" case, the renovated campus area buildings
- oral defence of the project: critical analysis of the solutions adopted for the campus

TEACHING AIDS

- https://www.envi-met.com/learn/

TEACHING LANGUAGE

English

CONTACT

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AIMS

GCU-4-S2-EC-M10 incompatible with M1, M4 et M14 (courses in the same time slots)

Adapting cities for climate change: Understanding the dynamics of the local environment to enable sustainable designs. Measure and evaluate the the effects of sustainable actions using a microclimate simulation software (ENVI_MET) that is based on objective scientific methods.

This sheet falls within the Course Unit "Optionnal module" : GCU-4-S2-UE-mod-opt and contributes to:

General Skills in Science for the Engineer:
A1- Analyze a real or virtual system (or problem)(level 2)
A2- Operate a model of a real or virtual system (level 2)
A4- Designing a system that meets a specification (level 3)
A6- Communicate a scientific analysis or approach with adapted situational conditions to the
specialty (level 2)

Skills specific to the speciality domain :
C15- Design and control good technical solutions for buildings in terms of thermal, airflow,acoustics (level 3)
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance (level 2)
C25- Contribute to sustainable planning and sustainable construction (level 1)

By mobilizing the following skills :
B3- Interact with others, work as a team
B4- FShow creativity, innovate and undertake
B5- Act responsibly in a complex world

By allowing the student to work and be assessed on the following knowledge:
- knowledges developed in the courses GCU-S-TC (Heat Transfers),GCU-S5-THB (Heat and mass transfers in buildings),GCU-S6-AC (Acoustic), GCU-S6-CLI (HVAC)

By allowing the student to work and be assessed on the following abilities:
- propose appropriate solutions with an holistic and multidisciplinary vision
- Microclimate and building physics: Interaction of outdoor microclimate with indoor climate, Energy exchange with outdoor Environment
- Wind patterns in complex environments,Pollutant dispersion, Wind comfort
- Solar analysis:¿ Sun and shade, Glazing analysis, Solar energy gain
-Benefits of façade and rooftop greening,Impact of green spaces and water

CONTENT

- Microclimate and building physics: Interaction of outdoor microclimate with indoor climate, Energy exchange with outdoor Environment
- Wind patterns in complex environments,Pollutant dispersion, Wind comfort
- Solar analysis:¿ Sun and shade, Glazing analysis, Solar energy gain
-Benefits of façade and rooftop greening,Impact of green spaces and water
- learning "ENVI_MET" environment(in support of Understanding the dynamics of the local environment to enable sustainable designs)

BIBLIOGRAPHY

- https://www.envi-met.com/intro/
- https://www.envi-met.com/learn/
- Darren Robinson, Computer Modelling for Sustainable Urban Design: Physical Principles, Methods and Applications,Routledge, 2011
-Daren Robinson,CITYSIM: Comprehensive Micro-Simulation of Resource Flows for Sustainable Urban Planning, July 2009, Eleventh International IBPSA ConferenceAt: Glasgow,Scotland

PRE-REQUISITES

knowledges developed in the courses GCU-3-S1-EC-TC (Heat Transfers),GCU-3-S1

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Villes et techniques : écotechnologies et transitions urbaines

IDENTIFICATION

CODE : GCU-4-S2-EC-M1
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Group work: poster and oral presentation (free format) by group

TEACHING AIDS

Collection of scientific texts (articles, extracts from books)

TEACHING LANGUAGE

French

CONTACT

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AIMS

GCU-4-S2-EC-M1 incompatible with M4, M14 et M10 (courses in the same time slots)

This EC is part of the teaching unit GCU-4-S2-UE-mod-opt (optional modules).

In particular, it deals with
- the role of objects in social activities ;
- the issues raised by the manufacture of objects and their mobilisation in everyday life (urban, technical, social, economic, organisational and political issues) ;
- the issues raised by the processes of technical change and urban transition (urban, technical, social, economic, organisational and political issues).

In doing so, it will enable students to work on
- observe and analyse urban situations ;
- integration of social, urban and environmental issues in development and construction projects.

CONTENT

Current urbanisation processes are characterised both by a generalisation of the urban phenomenon and by a double massification, of people and objects (with the diffusion of urban objects and the constitution of megacities). These processes raise problems on different scales and of various kinds: social, economic, environmental, political, etc. These problems have been the subject of several diagnoses since at least the 1970s: e.g. the Brundtland report and more recently the IPCC reports. Consensus seems to be emerging on the need for change: for example, in modes of travel, heating, recycling, energy production, etc. Despite this consensus, these changes are slow to materialise or fall short of what is needed.

In this context, this EC is concerned with issues surrounding technical change and urban transition processes. One of the hypotheses underlying this teaching is that the difficulties observed are partly the result of the "objects" available - objects whose manufacture is partly the activity of engineers. These difficulties would also reside in the social, political, urban and economic organisations in force (urban morphologies).

In this perspective, the objectives of this EC are :
- to analyse the role of objects in social activities and the conditions of their production;
- to review the "new" objects of the urban (e.g. eco-objects, eco-districts, digital and connected objects), the conditions of their development and generalisation as well as their realistic contribution to an urban transition (e.g. towards more environmentally, socially, politically virtuous societies, etc.);
- to re-examine, through the ongoing development of objects (known via the media, scientific articles, technical journals), the questions raised by current urbanisation and the processes of ongoing or projected transitions;
- to consider ways and action levers of developing the conditions for technical and urban change, which can participate in a transition.

PROGRAM :
- General elements on contemporary urbanisation processes and the urban, social, technical, political and environmental issues they raise: pollution, massification of cities, inequalities, social segregation, changes, etc. - CM (4hCM), conferences (8hTD), "Urban Controversies" seminar/project (26hTD)
- Project "Urban objects and transitions": collective project around a new "object" related to the issues dealt with in the course: elaborate and test an urban device, a development, a social organisation, etc. that could be a driving force in transition processes to other societies (to be defined). This project will be based on the CM, TD and seminars of the EC as well as on field surveys (especially on existing objects) - TD (30hTD)

BIBLIOGRAPHY

Non-exhaustive list

Akrich M., Callon M., Latour B., 2006, Sociologie de la traduction. Textes fondateurs, Paris, Mines Paris Les Presses

Gemenne F., Rankovic A., Atelier de cartographie de Sciences Po, 2019, Atlas de l'anthropocène, Paris, SciencesPo Les Presses

Gorz A., 1973, « L'idéologie sociale de la bagnole », Le Sauvage, septembre-octobre 1973, disponible sur http://carfree.fr/index.php/2008/02/02/lideologie-sociale-de-la-bagnole-1973/ (consultation le 10 janvier 2019)

Illich I., 1973, La convivialité, Paris, Seuil

Kopp A., 1975, Changer la vie, changer la ville. De la vie nouvelle aux problèmes urbains. U.R.S.S. 1917-1932, Paris, Union Générale d'Editions, coll. « 10/18 »

Latour B., 1992, Aramis ou l'amour des techniques, Paris, Editions La Découverte

Léger J.-M., 2006, Yves Lion. Logements avec architecte, Paris, Creaphis Editions

Pinson G., 2020, La ville néolibérale, Paris, PUF

PRE-REQUISITES

Requires a good level of French

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Biobased structures

IDENTIFICATION

CODE : GCU-4-S2-EC-M14
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Report
Oral defence

TEACHING AIDS

Lectures on line
Standard
Project

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-M14 incompatible with M1, M4 et M10 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes:
Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 2)
A3- Implement an experimental approach (level 2)
A4- Designing a system that meets a specification (level 2)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 1)
B3- Interact with others, work as a team (level 2)
B5- Act responsibly in a complex world (level 2)

Competences specific to the specialty:
C7- Civil Engineering Structures (design, dimension and control a ...) (level 2)
C12-Assess several building methods (level 2)
C25- Contribute to sustainable urban developments and sustainable construction (level 2)

Allows the student to work and be evaluated on the following knowledge:
- Functioning of timber structure (Eurocode 5) or in masonry (Eurocode 6)
- Natural resources management (wood, plants)
- Wood properties
- LCA: Life Cycle Assessment

Allows the student to work and be evaluated on the following abilities:
- Design a timber structure
- Choose materials according to specifications
- Implement a LCA
- Act in an environmental approach
- Set up, test and analyse the behaviour of a biobased structure

CONTENT

- Analyse and design a wood structure or in masonry: construction systems, stability, connections
- Resources management
- Processing of biobased materials
- Life Cycle Assessment (LCA)
- Project: Build, test and analyse a timber framework filled with a biobased material (hempcrete, earth,...)

BIBLIOGRAPHY

Y. Benoit, B. Legrand, V. Tastet, Calcul des structures bois, Eyrolles, Afnor, 2008
M. Hurez, N. Juraszek, M. Pelcé, Dimensionner les ouvrages en maçonnerie, Eyrolles, Afnor Editions, 2009.
Collectif SEBTP, Construire en chanvre: Règles professionnelles d'exécution, SEBTP , 2012
EN 1990. EUROCODE - basis of the constructive design. Dutch Standardization Institute, 2002.
EN 1995-1-1. Eurocode 5: design and calculation of wood constructions, Part1-1: general, common rules and rules for buildings, 2005.
Eurocode 6 (EC6), NEN-EN 1996-1-1, Design of masonry structures, Part 1-1: General rules for buildings. Rules for reinforced and unreinforced masonry, 2006.

PRE-REQUISITES

GCU-3-S1-EC-IAS1
GCU-3-S1-EC-IAS2
GCU-3-S1-EC-MA
GCU-3-S1-EC-MMC
GCU-3-S2-EC-BA
GCU-3-S2-EC-MAS-1
GCU-3-S2-EC-MAS-2
GCU-4-S1-EC-EAS1

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Materials : Experimentation and Modelling

IDENTIFICATION

CODE : GCU-4-S2-EC-M4
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

1 project report
1 TD synthesis

TEACHING AIDS

Duplicated documents
On-line documents

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-M4 incompatible with M1, M10 et M14 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 1)
A2- Operate a model of a real or virtual system (level 1)
A3- Implement an experimental approach (level 2)
A4- Design a system that meets specifications (level 2)
A5- Processing data (level 1)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 1)
B3- Interact with others, work as a team (level 2)
B4- Demonstrate creativity, innovate and undertake (level 2)

Competences specific to the specialty:
C7- Building structure (design, dimension and control a ...) (level 2)
C8- Civil Engineering Structures (design, dimension and control a ...) (level 2)
C12-Assess several building methods (level 2)
C15- Design and control good technical solutions for buildings in terms of thermal, airflow, acoustics (level 2)
C25- Contribute to sustainable urban developments and sustainable construction (level 2)

Allows the student to work and be evaluated on the following knowledge:
- Hydration phenomena of cementitious materials
- Modeling the early age behavior of cement matrix materials
- Characterization techniques for cementitious materials at a early age
- Characterization techniques on hardened materials
- Dynamic behavior of homogeneous and heterogeneous materials
- Dispersive and non-dispersive media
- Reflection and transmission at the interface between two materials
- Materials as wave traps

Allows the student to work and be evaluated on the following abilities:
- To propose a hydration reaction scheme
- To identify the phenomena involved at a early age
- To integrate data into a model
- To use modeling software (Comsol)
- Data exploitation
- To propose laws of behavior
- To design new materials for the absorption of vibrations and noise

CONTENT

Ecology and sustainable development are now a major issue in the field of Civil Engineering. This induces the development and use of more and more specific materials, whose properties are fundamental to their efficiency. Experimental study and modeling are needed in order to predict their behavior in the short term as well as in the long term. This EC allows the student to understand that the behavior of materials can be very different if we consider different scales and basic constituents.
The option will therefore be organized around the consideration of two scales of size and time.
* Microstructure and early age: Around a project directly related to the application domain (slab screed, ...), different parameters (formulation, curing conditions, setting) will be considered from an experimental point of view and modeling. The measurements carried out on the samples will allow the simulation of material behavior on the software COMSOL.
* Dynamical behavior of homogeneous and heterogeneous metamaterials at the macroscopic scale (scale of the specimen): In a first part of the course, basic results concerning the dynamical behavior of homogeneous, non-dispersive materials will be provided. Moreover also the needed mathematical tools will be introduced (variational methods and elastodynamics equations).
Secondly, new metamaterials with architectured microstructure will be introduced and the study of their dispersive behavior will be addressed. These heterogeneous, dispersive materials can show exotic dynamical properties allowing the inhibition of elastic waves propagation thanks to their underlying architectured microstructure.
The introduced models will allow the student to get familiar with these new metamaterials and to propose new solutions for civil engineering applications (absorption of vibrations and noise, seismic protection, etc.)

BIBLIOGRAPHY

PRE-REQUISITES

Continuum mechanics
Materials Science
General mathematics

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Vulnerability of structures in their environment: advanced modelling of structures

IDENTIFICATION

CODE : GCU-4-S2-EC-M5
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Oral defense

TEACHING AIDS

Oral presentation
Lessons documents
Software MATLAB
Code sources MATLAB

TEACHING LANGUAGE

French

CONTACT

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AIMS

GCU-4-S2-EC-M5 incompatible with M3, M6 et M13 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to :

Competences in Engineering Science:
A1 - Analyze a real or virtual system (or problem) (level 2)
A2 - Operate a model of a real or virtual system (level 2)
A6 - Communicate a scientific analysis or approach (level 2)

Competences specific to the specialty :
GCU-C1 : C7 - Building structure (design, dimension and control a...) ; (level 3)
GCU-C2 : C8 - Civil Engineering Structures (design, dimension and control a...) ; (Level 3)
GCU-C6 : C12 -Assess several building methods ; (Level 2)
GCU-T3 : C25 - Contribute to sustainable urban developments and sustainable construction ; (Level 2)

Allows the student to work and be evaluated on the following knowledge:
+ Dynamic equation within the framework of structural analysis (1 DOF (Degree Of Freedom) system and generalization to N DOF). Modal analysis. Solving a problem with the finite element method. Direct time integration through time via Newmark integration schemes.
+ Non linear structural analysis (material non linearity)

Allows the student to work and be evaluated on the following abilities:
+ Model the dynamic response of a structure subjected to an earthquake or an impact loading
+ Validate and analyze results coming from finite element numerical simulations

CONTENT

Lectures
+ Finite Element Method within Dynamics framework
+ Non Linear Finite Element Method (Material non linearity)

Tutorials
+ Beam modeling (Euler-Bernoulli)
+ Earthquake Engineering (Modal Spectral Analysis)
+ Structures under impact loading

Project
+ Modeling concepts of civil engineering structure subjected to an earthquake and an impact (with the help of MATLAB)
+ Modal Analysis
+ Direct Integration (Newmark Algo.)
+ Time history response of the post-beam structure
+ Spectral (rules-based approach) and direct integration approaches comparison

BIBLIOGRAPHY

Batoz J-. L. et Gouri Ghatt., Modélisation des structures par éléments finis. Hermès, 1990

Blaauwendraad, J. Plates and FEM Springer, 2010

Biggs, J. Introduction to structural dynamics McGraw-Hill, 1964

Brossard, J. Dynamique : théorie classique du choc Techniques de l'ingénieur, Techniques de l'ingénieur, 2008

Cazenaze, M. Méthode des éléments finis - Approche pratique en mécanique des structures Dunod, 2010

Chopra, A. Dynamics of structures - Theory and Application to Earthquake Engineering Prentice Hall, 1995

Goldenveizer, A. On Reissner's theory of the bending of plates National Aeronautics and Space Administration (NASA), National Aeronautics and Space Administration (NASA), 1960

Reddy, J. (Ed.) Mechanics of laminated composite plates and shells - Theory and Analysis CRC Press, 1997

Zienkiewicz, O. & Taylor, R. The finite element method for solid and structural mechanics 1967

PRE-REQUISITES

+ Energy methods and finite element method (GCU-3-S2-EC-MAS-1 et GCU-3-S2-EC-MAS-2)
+ Static, Material Strength, Beam theory (GCU-3-S1-EC-IAS1 et GCU-3-S1-EC-IAS2)
+ Continum Mechanics (GCU-3-S1-EC-MMC)
+ Advanced Structural Analysis (GCU-4-S1-EC-EAS1 et GCU-4-S1-EC-EAS2)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Engineering-Architecture : Innovation Practices and Processes

IDENTIFICATION

CODE : GCU-4-S2-EC-M6
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Teamwork
Several (3 or 4)) presentations
Final report (will be evaluated by the professors in charge of this course) and final presentation in front of a large jury of experts

TEACHING AIDS

Néant

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-M6 incompatible with M3, M5 et M13 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to:

Competences in Engineering Science:
Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)
A3- Implement an experimental approach
A4- Design a system that meets specifications
A5- Process data
A6- Communicate a scientific analysis or approach

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously
B3- Interact with others, work as a team
B4- Demonstrate creativity, innovate and undertake
B5- Act responsibly in a complex world
B7- Work in an international and intercultural context

Competences specific to the specialty:
C23- Contribute to a pluri-disciplinary design process of buildings
C25- Contribute to sustainable urban developments and sustainable construction

CONTENT

Learn to identify and test innovative solutions for sustainable urban development.
Teamwork with architect students

BIBLIOGRAPHY

Néant

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Urbanisme et aménagement durable des territoires

IDENTIFICATION

CODE : GCU-4-S2-EC-M3
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Evaluation will be done in the context of individual and collective projects.

TEACHING AIDS

Teaching materials :
- mimeographed documents
- PPT media
- Case study files

TEACHING LANGUAGE

French

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AIMS

GCU-4-S2-EC-M3 incompatible with M5, M6 et M13 (courses in the same time slots)

This transversal option contributes to the acquisition of knowledge taking into account the major contemporary issues of sustainability in the field of major urban technical networks (water, stormwater, remediation project, roads, cleanliness, telecommunications, ...).

It contributes to the achievement of :

Competences in Engineering Science :
A1 : Analyse a real or virtual system (or problem)
A3 : Implement an expérimental approach
A4 : Design a system that meets specifications

Competences in Humanities, Documentation and Physical and Sports Education :
B2 : Work, learn, progress autonomously
B3 : Interact with others, Works as a team
B4 : Demostrate creativity, innovate and undertake

Competences specific to the speciality :
C10 : Infrastructure project management
C13 : Asses the structural health, define mandatory actions
C20 : Analyse urban context (technical, political and social patterns at different scales)
C21 : Achieve a global urban diagnosis
C22 : Design and lead a town-planning project
C25 : Contribute to sutainable urban developments and sustainable construction

CONTENT

Program :
- Knowledge of the technical and sustainability issues of major urban technical networks
- Taking into account sustainability issues for the proposal of new technical solutions for networks.

BIBLIOGRAPHY

- Polycopié du cours de V.R.D
- Guide pratiques des VRD et aménagements extérieurs, Gérard Kaarsenty, édition Eyrolles.
- Assainissement - VRD, cours Frédéric Visa, 6 mars 2015. On line : http://www.cours-genie-civil.com/assainissement-vrd/

PRE-REQUISITES

The knowledge acquired in the third year and the first semester of the fourth year will be prerequisites

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Integrated urban water management

IDENTIFICATION

CODE : GCU-4-S2-EC-M13
ECTS : 5.00

HOURS

Cours :	0h
TD :	60h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	60h
Travail personnel :	80h
Total :	140h

ASSESMENT METHOD

Scientific dissertation
Oral presentation

TEACHING AIDS

Lectures & seminars
Books (see Bibliography)
Reports
Different softwares

TEACHING LANGUAGE

English

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AIMS

GCU-4-S2-EC-M13 incompatible with M3, M5 et M6 (courses in the same time slots)

This module is part of the course unit GCU-4-S2-UE-mod-opt and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)(level 3)
A2- Operate a model of a real or virtual system (level 3)
A4- Designing a system that meets a specification (level 3)
A5- Process data (level 2)
A6- Communicate a scientific analysis or approach (level 3)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 3)
B3- Interact with others, work as a team (level 3)
B4- Demonstrate creativity, innovate and undertake (level 3)
B5- Act responsibly in a complex world (level 2)
B7- Work in an international and intercultural context (level 2)

Specific competences:
C17- Designing and sizing networks and structures based on hydrologic and hydraulic approaches for urban planning, buildings and civil engineering infrastructures (level 3)
C18 - Quantitative analysis of hydrologic processes and to manage networks, structures and urban planning (level 3)
C19- Environmental assessment of urban water management systems or components (level 2)
C22- Design and manage an urban planning (level 3)

Allowing the student to work and be evaluated on the following knowledges:
- sustainable urban water management strategies accounting for: climate change, new stormwater principles (e.g. WSUD, Green infrastructures), improvement or preservation of ecological quality of receiving water bodies

Allowing the student to work and be evaluated on the following abilities:
- gain general and multidisciplinary knowledge on water management in urban areas
- design and size original integrated water management in urban project
- propose innovative solutions for sustainable management of urban waters

CONTENT

The module will be divided into two parts:
Part 1- Broad view on multidisciplinary knowledge about water management in urban areas, including:

- New management principles: Overall view of urban water cycle and main processes with a focus on processes involved in green infrastructures (e.g. Evapotranspiration, infiltration), Water wise management principles (in particular those stand by International Water Association), Change of urban water management paradigm and related new skills, Waste Water management
- Environment and urban planning issues related to water management: Ecology of receiving waters, maintenance and operation (Sediment accumulation and management in stormawater facilities), Water and architecture, Preparing to climate change, landscape planning, Biodiversity and water management
- Social issues: social acceptance by stakeholders and people in charge of urban services, new trades involved, regulations

Part 2- Lead a project on water management in urban areas

BIBLIOGRAPHY

Gustaf Olsson (2012). Water and Energy - Threats and Opportunities. IWA publishing, 300 pages, ISBN-13: 9781780400266; eISBN: 9781780400693

Thorkild Hvitved-Jacobsen, Jes Vollertsen, Asbjorn Haaning Nielsen (2013). Sewer processes - Microbial and chemical process engineering of sewer networks. 2nd ed, CRC Press Taylor & Francis Group, 379 pages,ISBN-13:978-1-4398-8177-4

Elpida Kolokytha, Satoru Oishi, Ramesh S.V. Teegavarapu (ed)(2017). Sustainable Water Resources Planning and Management Under Climate Change.Springer, 303 pages, DOI https://doi.org/10.1007/978-981-10-2051-3, Print ISBN: 978-981-10-2049-0, Online ISBN: 978-981-10-2051-3.

Meir Russ (ed) (2018). Handbook of Knowledge Management for Sustainable Water Systems. Wiley-Blackwell, 328 pages, ISBN: 978-1-119-27163-5.

PRE-REQUISITES

Basics of Urban drainage, hydrology and hydraulics
Basics of decision making

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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R&D initiation project

IDENTIFICATION

CODE : GCU-5-S1-EC-PIRD
ECTS : 12.00

HOURS

Cours :	0h
TD :	2h
TP :	0h
Projet :	200h
Evaluation :	0h
Face à face pédagogique :	2h
Travail personnel :	0h
Total :	202h

ASSESMENT METHOD

The general outcomes are, at least:
- a literature review;
- a final report;
- an oral defense.

Specific expected deliverables may be:
- experimental set-up;
- database;
- model;
- software;
- etc.

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

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AIMS

This module is part of the course unit GCU-S9-PIRD and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (level 3)
A2- Operate a model of a real or virtual system (level 3)
A3- Implement an experimental approach (level 3)
A5- Process data (level 3)
A6- Communicate a scientific analysis or approach (level 3)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, progress autonomously (level 3)
B3- Interact with others, work as a team (level 3)

Competences specific to the specialty:
(depend on the research laboratory that hosts the R&D project)

Mobilizes the following competences:
B4- Demonstrate creativity, innovate and undertake

Allows the student to work and be evaluated on the following knowledge:
- knowledge in civil engineering or urban planning, specific to the field of the R&D project;
- even knowledge in related fields;

Allows the student to work and be evaluated on the following abilities:
- contribute effectively to the organization of the R&D study, that is to say: show initiative, work autonomously, work as a team, contribute to the project management (organization and animation of meetings, reports ...), check the relevance of the work with the tutor;
- contribute effectively to the scientific approach of the study, that is to say: reformulate questions, translate engineering problems into questions and hypotheses of research, co-build a study process;
- conduct and use a literature review, support its research on sufficiently numerous and relevant sources and correctly cited in the text and in the list of references, evaluate these sources, compare them;
- produce original results (method, model, experimental device, results of experiments ...) and know how to exploit them, evaluate them, define perspectives;
- communicate effectively and rigorously orally;
- communicate effectively and rigorously with a report.

CONTENT

The PIRD project is supervised by one (or two) faculty member(s) within one of these five research axes:
- Heat & Mass Transfers in Buildings;
- Materials and Structures;
- Soils, Geo-materials;
- Urban Techniques & Society;
- Urban Water Management.

Projects generally deal with engineering problems defined by faculty members together with industrial partners.

BIBLIOGRAPHY

- Couture M., Fournier R.-P. (sous la direction de) (1997) La recherche en sciences. Guide pratique pour les chercheurs. Paris : De Boeck Université, 250 p.
- Pagé, J., Boisclair, G., Mathieu, R. (1998) Guide des sciences expérimentales. Méthodes et démarches. Paris : De Boeck Université, 197 p.
- Walliser, B. (1977) Systèmes et modèles. Paris : Seuil.
- Boudia D., Nadji F. (2018). Plagiat, citation et références bibliographiques [en ligne]. Villeurbanne : INSA Lyon, 2018. Disponible sur : http://referencesbibliographiques.insa-lyon.fr/ (Consulté le 03/09/2018)
- Butler, A. (2006) Comment rédiger un rapport ou une publication scientifique ? [En ligne]. Lausanne(Suisse) : Ecole Polytechnique Fédérale de Lausanne. Disponible sur (consulté le 01/10/2014) :

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
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Biodiversity

IDENTIFICATION

CODE : GCU-5-S1-EC-BIODIV
ECTS : 1.00

HOURS

Cours :	10h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	12h
Travail personnel :	0h
Total :	12h

ASSESMENT METHOD

TEACHING AIDS

- Course document available on moodle

TEACHING LANGUAGE

French

CONTACT

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jean-francois.georgin@insa-lyon.fr

AIMS

Compétences école en science de l'ingénieur
-

Compétences école en humanités, documentation et éducation physique et sportive
-

Compétences école spécifiques à la spécialité
C25 - Contribuer à des aménagements et constructions durables

En permettant à l'étudiant de travailler et d'être évalué sur les connaissances suivantes :
- biodiversité (contexte, définition et enjeux associés)
- réglementation environnementale appliquée à la biodiversité
- prise en considération de la biodiversité dans l'acte de construire

En permettant à l'étudiant de travailler et d'être évalué sur les capacités suivantes :
- expliciter ce qu'est la biodiversité
- comprendre le cadre réglementaire
- intégrer la préservation et l'accueil de la biodiversité dans l'acte de construire.

CONTENT

- Introduction to biodiversity and related issues
- Biodiversity in French regulations
- Integrating biodiversity into the act of building

BIBLIOGRAPHY

None

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
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2020 Environmental Regulations

IDENTIFICATION

CODE : GCU-5-S1-EC-RE2020
ECTS : 1.00

HOURS

Cours :	10h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	12h
Travail personnel :	0h
Total :	12h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
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Building pathology

IDENTIFICATION

CODE : GCU-5-S1-EC-PATHO
ECTS : 1.00

HOURS

Cours :	10h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	12h
Travail personnel :	0h
Total :	12h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

School competencies in engineering sciences
- ...

School competencies in humanities, documentation, and physical education and sports
- ...

School competencies specific to the specialization
C13 - Evaluate the structural health condition, define necessary actions

By enabling students to work on and be assessed on the following knowledge:
- Identify and characterize the main structural pathologies, particularly those of concrete;
- Master different diagnostic methodologies (visual, materials, and structural);

By enabling students to work on and be assessed on the following skills:
- ... (to be completed)

CONTENT

1. Introduction to Structural Pathology
- Definition, challenges, and objectives of structural diagnosis

2. Diagnostic Methodology
- Visual diagnosis
- Materials diagnosis
- Structural diagnosis

3. Techniques and Investigation Methods
- Instrumentation and monitoring
- Remote inspection (drones, remote sensing, photogrammetry)
- Non-destructive testing methods
- Destructive investigations (sampling, coring)

4. Common Concrete Pathologies
- Identification, analysis, and main causes of pathologies
- Case studies and practical examples

5. Image-based Diagnostics
- Interpretation and application of imaging techniques for pathology analysis (thermography, radar imaging, radiography)

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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20 Avenue Albert Einstein - 69100 VILLEURBANNE

Urban Planning project

IDENTIFICATION

CODE : GCU-5-S1-EC-PMAU
ECTS : 12.00

HOURS

Cours :	0h
TD :	200h
TP :	0h
Projet :	200h
Evaluation :	0h
Face à face pédagogique :	200h
Travail personnel :	0h
Total :	400h

ASSESMENT METHOD

A collective project, report and public oral presentation

TEACHING AIDS

slides and booklets

TEACHING LANGUAGE

French

CONTACT

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AIMS

IMPORTANT INFORMATION : this course is dedicated to students in their last year of studies

Competences :

B3- Interact with others, work as a team

B5- Act responsibly in a complex world

C20- Analyse an urban context (technical, political and social patterns at different scales)

C22- Design and manage a town-planning project

AIMS :

- design an urban project and achieve the whole planning process (laws, technics, economics)

CONTENT

- an operational urban planning project in three phases: intentions, composition, editing, in a real case, under the command of a developer from the Lyon area (SERL group)

- Workshops in teams supervised by town planners, architects and engineers

- lessons:
Urban mobility
Housing policies
Environmental studies
Operation setup
Land strategies
Graphic Representation

WARNING : this project can't be chosen with PIOA and PBAT

BIBLIOGRAPHY

Memento de l'aménagement, SCET, Paris, 2012
Pour un urbanisme de projet, J. Belmer, Ellipses, 2011

PRE-REQUISITES

Good level in French (Level B2)
Basic knowledge of French city planning

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Infrastructure and civil engineering works project

IDENTIFICATION

CODE : GCU-5-S1-EC-PIOA
ECTS : 12.00

HOURS

Cours :	0h
TD :	200h
TP :	0h
Projet :	200h
Evaluation :	0h
Face à face pédagogique :	200h
Travail personnel :	0h
Total :	400h

ASSESMENT METHOD

Reports
Oral defences

TEACHING AIDS

Lessons
Standard
Projets

TEACHING LANGUAGE

French

CONTACT

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AIMS

IMPORTANT INFORMATON : this course is dedicated to students in their last year of studies

This module is part of the course unit GCU-5-S1-UE-PM and contributes to:

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem)(level 3)
A2- Operate a model of a real or virtual system (level 3)
A4- Designing a system that meets a specification (level 3)
A5- Processing data (level 3)
A6- Communicate a scientific analysis or approach (level 3)

Competences in Humanities, Documentation and Physical and Sports Education:
B2- Work, learn, evolve autonomously (level 3)
B3- Interact with others, work as a team (level 3)
B4- Demonstrate creativity, innovate and undertake (level 3)

Competences specific to the specialty:
C7- Building structure (design, dimension and control ...) (level 3)
C8- Civil Engineering Structures (design, dimension and control ...) (level 3)
C9- Highway and rail infrastructure (design, dimension and control a...) (level 3)
C10- Infrastructure project management (level 3)
C11-Perform an environmental analysis of an infrastructure (level 3)
C12-Assess several building methods (level 3)
C25- Contribute to sustainable urban developments and sustainable construction (level 3)
C26- Manage assets (assessment, maintenance, rehabilitation) (level 3)

Allows the student to work and be evaluated on the following knowledge:
Definition and development of a infrastructure project
Design of a bridge

Allows the student to work and be evaluated on the following abilities:
To know the different stages of a mutlimodal infrastructure project
To identify the actors and their respective responsibilities.
To use the body of knowledge in structural design on a bridge project

CONTENT

Road project
- Take into account the different needs and constraints.
- Determination of the longitudinal section and of the cross-section.
- Design of the solution (pavement, earthwork, hydraulic structures, ...)

Bridge project
- Schematic design phase of a bridge.
- Proposal of a technical solution.

WARNING : this project can't be chosen with PMAU and PBAT

BIBLIOGRAPHY

J.A. Calgaro et A. Bernard-Gély : Conception des Ponts. Cours de l'Ecole Nationale des Ponts et Chaussées, Presses de l'ENPC.
Jean-Armand Calgaro : Projet et construction des Ponts. Presses de l'ENPC.
Eurocode 1 - Partie 2 : Charges sur les Ponts Routes.
Fascicule 61 - Titre II : Conception, calcul et épreuves des ouvrages d'art.
Eurocode 2 : Calcul des structures en béton - Partie 1-1 : Règles générales et règles pour les bâtiments.
Eurocode 3 : Calcul des structures en acier.
Eurocode 4 : Calcul des structures mixtes acier-béton.

PRE-REQUISITES

Good level of oral and written French (Level C1)
GCU-3-S1-EC-IAS1
GCU-3-S1-EC-IAS2
GCU-3-S1-EC-MMC
GCU-3-S2-EC-BA
GCU-3-S2-EC-MAS-1
GCU-3-S2-EC-MAS-2
GCU-4-S1-EC-BP
GCU-4-S1-EC-EAS1
GCU-4-S1-EC-EAS2

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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Building, Environment and Comfort Project

IDENTIFICATION

CODE : GCU-5-S1-EC-PBAT
ECTS : 12.00

HOURS

Cours :	0h
TD :	200h
TP :	0h
Projet :	200h
Evaluation :	0h
Face à face pédagogique :	200h
Travail personnel :	0h
Total :	400h

ASSESMENT METHOD

The evaluation is based on the notes for each of the technical part, a note for the oral presentation and the opinions of the project tutors.

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

IMPORTANT INFORMATION : this course is dedicated to students in their last year of studies

Competences in Engineering Science:
A1- Analyze a real or virtual system (or problem) (Level 3)
A4- Design a system that meets specifications (Level 3)
A6- Communicate a scientific analysis or approach (Level 3)

B1- Se connaître, se gérer physiquement et mentalement (Level 2)
B2- Travailler, apprendre, évoluer de manière autonome (Level 3)
B3- Interagir avec les autres, travailler en équipe (Level 3)
B4- Faire preuve de créativité, innover entreprendre (Level 3)
B5- Agir de manière responsable dans un monde complexe (Level 2)

Competences specific to the specialty:
C1- Perform, interpret a geological profile, interpret a map or remote sensing result, identify a geological horizon
C2- Perform and/or interpret geotechnical laboratory tests for classification and behavior
C6- Design, dimension, model or verify foundation and retaining systems;
C7- Building structure (design, dimension and control a...)
C12-Assess several building methods
C15- Design and control good technical solutions for buildings in terms of thermal, airflow, acoustics
C16- Assess the state of health of a building, thermal or acoustic performance of a building or equipment, define actions necessary to improve performance
C17- Designing and sizing networks and structures based on hydrologic and hydraulic approaches for urban planning, buildings and civil engineering infrastructures
C23- Contribute to a pluri-disciplinary design process of buildings

CONTENT

The professinal project runs throughout the semester with a fixed slot on Fridays all day long. This project is a pedagogical exercise that places students in situations close to the professional world. They are asked to participate actively in the design of equipment for a proposed program, an engineering situation, by taking into account architectural, sociological, societal, economic, and technical issues. This work features several actors around the same project. The proposed buildings must be buildable. The project management is part of the exercise.

Initially there is a program and design teams. In the industrial context, for a simple-design residential building, the preliminary design and the detailed design require two to three months of work by a team devoted practically full-time. For the "building project", carried out in a few weeks, the common ambition is a little different, because, on one hand, time does not allow the complete simulation of the professional reality and, on the other hand, the objective is different since in the end the designed project is not intended to be built. These elements led to the design of the "building project" with a slightly different approach to reality, the important thing being to implement professional approaches and manage the interactions between these approaches.

Professionals and teachers are available to groups of students to answer their questions.

The project is organized in accordance with the law n ° 85-704 of July 12th, 1985 relative to the public contracting authority (MOP law) in the sketching phases (ESQ), preliminary draft (APS and APD), and project (PRO).

The evaluation is based on the notes for each of the technical part, a note for the oral presentation and the opinions of the project tutors.

WARNING : this project can't be chosen with PMAU and PIOA

BIBLIOGRAPHY

PRE-REQUISITES

Have followed 4 years of civil engineering and have a minimum level of French C1 (for example DELF - DALF).

Geotechnics 1 : Identification of soils and hydraulics (GCU-3-S1-EC-IMRS)
Geotechnics 2 : Soil mechanics (GCU-S6-GEO-2)

Structural analysis methods (GCU-S6-MAS-1 et GCU-S6-MAS-2)
Initiation to structural analysis (GCU-S5-IAS1 et GCU-S5-IAS2)
Continuum Solid Mechanics (GCU-S5-MMC)

Thermodynamics (PC-S2-TH)
Heat transfer (GCU-S5-TC)
Thermo-aerodynamics behaviour of buildings (GCU-S5-THB)
Air conditioning (GCU-S6-CLI)

Fluid mechanics (GCU-S6-MF)

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Human sciences for engineers : the transition

IDENTIFICATION

CODE : GCU-5-S1-EC-SHIFT
ECTS : 2.00

HOURS

Cours :	4h
TD :	4h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	8h
Travail personnel :	0h
Total :	8h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

For foreign students: minimum level C1 in French

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : GCU-5-S2-EC-STG
ECTS : 30

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	1h
Travail personnel :	0h
Total :	1h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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