

Module Description

Module Code	MESISI481822	Domain	Sciences de l'ingénieur
Module Label	Building Thermal Simulation	Module Manager(s)	Pascal CLAIN
International Label		Managing Teachers	Pascal CLAIN
Instructional Language	EN		

Relevant Curriculum

School	Programm	Curriculum	Track	Term	Teaching Unit	Coeff/ECTS
ESILV	PGE ESILV	ESILV ANNEE 4 - ALTERNANCE - EVD	Core Track	S08	BUILDING ENERGY MODELLING	3.00
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Durations

Evaluation Methods	
Lecture	6h00
Practical tutorial	30h00
Face to Face Total	36h00
Individual Work	44h00
Student Total	80h00

Detailed Module Description

General Objective (EN)

This course provides a critical understanding of, and applied practice in, building performance simulation with an emphasis on energy modeling. This emerging field utilizes quantitative data to evaluate sustainability design goals and energy code compliance in buildings, as implemented jointly by architects and engineers. Course topics cover basic building systems, how their use of energy is calculated, and how their performance can be measured, characterized, and optimized. Students will develop working competence in one of the most popular building modeling tools, Pleiades, and with a set of skills that will be applicable regardless of the specific simulation tool being used.

Content (EN)

- Basics of thermal simulation:
 - o Principles of thermal simulation
 - o Role of thermal simulation in building design
 - o Building thermal characteristics and performance criteria
- Approaches to thermal modeling of the building
 - o Dynamic thermal simulation tools:
 - o Presentation of dynamic thermal simulation tools
 - o Simulation capabilities, building input and results
- Realization of dynamic thermal simulation:
 - o Modeling of the building (architecture, uses, materials, air flow...)
 - o Study of the thermal performance of the building (heating and cooling needs, interior temperature, thermal comfort...)
 - o Study of solutions to improve the energy performance of the building (orientation, glazed surface, insulation, waterproofing...)

Prerequisites (EN)

Thermodynamics, Heat transfer

Bibliography (EN)

AIA An Architects Guide to Integrating Energy Modeling in the Design Process (free download after registration, <http://info.aia.org/aia/energymodeling.cfm>)
 ASHRAE Handbooks (Fundamentals, HVAC Systems & Equipment, Applications—various years)
 ASHRAE AEDG (Advanced Energy Design Guide): SMALL OFFICE BUILDINGS (free download after registration, go to

ASHRAE.org and search "advanced energy design guides" or google directly)

Banham, Reyner The Architecture of the Well-tempered Environment Architectural Press 1969 Bonneville Power

Administration Guidelines for Energy Simulation of Commercial Buildings 1992 (available on line, pdf download)

Clarke, JA Energy Simulation in Building Design Routledge 1985

Hensen, Jan & R. Lamberts Building Performance Simulation (ON RESERVE IN ARCH LIBRARY)

Heschong, Lisa Thermal Delight in Architecture MIT Press 1979

Underwood, Christopher and Francis Yik Modeling Methods for Energy in Buildings

Blackwell 2004 Waltz, James Computerized Building Energy Simulation Handbook Fairmont Press 2000

Targeted Skills (EN)

- 1- Conduct building energy and mass transfer analysis using comprehensive computer simulation tools.
- 2- Evaluate the performance of building envelope and environmental systems considering energy and mass transfer in building.
- 3- Ability to apply models to common building industry functions such as comparison of design features, selection of equipment, energy audits and retrofits, code compliance

Pedagogical Methods (EN)

- 1- Enseignement en face à face
- 2- Pédagogie par projets

Module Layout

Session	Type	Duration	Individual Work	Theme
1	Lecture	1h30		Heat balance (conduction, convection, radiation)
2	Practical tutorial	1h30		Exercises for calculating losses
3	Practical tutorial	1h30		General presentation + tools / Exercise (1/3) - Library entry
4	Lecture	1h30		Solar contribution + thermal balance
5	Practical tutorial	1h30		Exercises to calculate solar heat gain and heating needs (simplified method)
6	Practical tutorial	1h30		Exercise (2/3) - Alcyone input / First simulations
7	Lecture	1h30		Ventilation + aerodynamic network
8	Practical tutorial	1h30		Natural ventilation + network balancing exercises
9	Practical tutorial	1h30		Rehabilitation Project Montreuil (1/13) - Diagnosis of the existing
10	Practical tutorial	1h30		Rehabilitation Project Montreuil (2/13) - Diagnosis of the existing
11	Lecture	1h30		Comfort + STD
12	Practical tutorial	1h30		Exercise to solve the balance equation of a thermal zone
13	Practical tutorial	1h30		Exercise (3/3): Comfort analysis and processing, and advanced features
14	Practical tutorial	1h30		Rehabilitation Montreuil Project (3/13) - Evaluation of solutions
15	Practical tutorial	1h30		Rehabilitation Montreuil Project (4/13) - Evaluation of solutions
16	Practical tutorial	1h30		Rehabilitation Montreuil Project (5/13) - Finalization of "classic" study
17	Practical tutorial	1h30		Rehabilitation Montreuil Project (6/13) - Finalization of "classic" study
18	Practical tutorial	1h30		Rehabilitation Montreuil Project (7/13) - Extension ASAI
19	Practical tutorial	1h30		Rehabilitation Montreuil Project (8/13) - Extension ASAI
20	Practical tutorial	1h30		Rehabilitation Project Montreuil (9/13) - Economic calculations
21	Practical tutorial	1h30		Rehabilitation Project Montreuil (10/13) - Economic calculations
22	Practical tutorial	1h30		Rehabilitation Project Montreuil (11/13) - Environmental calculations
23	Practical tutorial	1h30		Rehabilitation Project Montreuil (12/13) - defense or report
24	Practical tutorial	1h30		Rehabilitation Project Montreuil (13/13) - defense or report

Nombre de groupes par typologie

Type	Nombre d'heures	Nombre de groupes	Total heures
CM	6h00	1	6h00
TD	30h00	2	60h00

Déroulement logistique du module

N° séance	Durée	Type	Logistique	Intervenant(s)	Commentaires
1	1h30	CM 1			
2	1h30	TD 1	Salle pour ordinateurs portables		
3	1h30	TD 2	Salle pour ordinateurs portables		
4	1h30	CM 2			
5	1h30	TD 3	Salle pour ordinateurs portables		
6	1h30	TD 4	Salle pour ordinateurs portables		
7	1h30	CM 3			
8	1h30	TD 5	Salle pour ordinateurs portables		
9	1h30	TD 6	Salle pour ordinateurs portables		
10	1h30	TD 7	Salle pour ordinateurs portables		
11	1h30	CM 4			
12	1h30	TD 8	Salle pour ordinateurs portables		
13	1h30	TD 9	Salle pour ordinateurs portables		
14	1h30	TD 10	Salle pour ordinateurs portables		
15	1h30	TD 11	Salle pour ordinateurs portables		
16	1h30	TD 12	Salle pour ordinateurs portables		
17	1h30	TD 13	Salle pour ordinateurs portables		
18	1h30	TD 14	Salle pour ordinateurs portables		
19	1h30	TD 15	Salle pour ordinateurs portables		
20	1h30	TD 16	Salle pour ordinateurs portables		
21	1h30	TD 17	Salle pour ordinateurs portables		
22	1h30	TD 18	Salle pour ordinateurs portables		
23	1h30	TD 19	Salle pour ordinateurs portables		
24	1h30	TD 20	Salle pour ordinateurs portables		

Intervenants

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VACATAIRE

CM			TD		
H	Grp	Site	H	Grp	Site
6.00	1	Paris	30.00	2	Paris

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Commentaires