CENTRALE NANTES

ENGINEERING PROGRAMME

2025-2026

Year 2 / Year 3

Specialisation option

Low-Tech Engineering - Sustainable housing techniques

OD TYLOTEC

PROGRAMME SUPERVISOR

Jean-Marc BEN GUIGUI

Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73	12	Core course	INGLOW LOWTEC1 MALORE	Low-tech Engineering Low-tech Project Low-tech, ethical and responsible management
UE 74	13	Core course	COFALO HABILO LOWTEC2	Low-tech design and manufacturing Ecological and low-tech housing Low-tech Project 2

Spring Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 83	14	Core course	HABITE LORIZON LOWTEC3	Sustainable housing and responsible territory Low-tech deepening Low-tech Project 3

Low-tech Engineering [INGLOW]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI

Objectives

This module aims to provide an in-depth understanding of low-tech issues, key concepts such as low-tech systems and eco-design, as well as concrete practices such as design for low-tech and the circular economy. Students will explore the application areas of low-tech, meet industry players and acquire essential skills to address environmental, social and economic challenges in an innovative and sustainable way.

Course contents

- Introduction to low-tech issues
- Definition of Low-Tech systems and the approach
- Travel and meetings with Low-Tech players
- Definition of needs and uses
- Design at the service of Low-Tech
- Innovation approach and tools
- Eco-Design methods and environmental assessment
- Circular economy

Course material

Bihouix, P. (2014). L'âge des low tech: vers une civilisation techniquement soutenable. Éditions du Seuil.
Raworth, K. (2017). La Théorie du Donut.

Skills developed through this course

- C1 : Design and prototype innovative systems that create value
  - C1C1 : Develop
    - Intermediate
    - Proficient
  - C1C2 : Dare
    - Intermediate
    - Proficient
  - C1C3 : Deliver and create value
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Climate action / Industry, innovation and infrastructure / No poverty / Responsible consumption and production / Sustainable cities and communities

Sustainable Development and Social Responsibility Positioning

This course establishes the theoretical and systemic foundations of sustainable development. It addresses planetary boundaries, resource scarcity, and Life Cycle Assessment (LCA). The core issues are tackled through triple bottom line

accounting (financial, environmental, and social) and interactions with stakeholders from the social and solidarity economy.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Low-tech Project [LOWTEC1]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI

Objectives

The realization of the sustainable housing project by the students with our partners Kerloc and Apala is broken down into modules of three times 136 hours over periods 1, 2 and 3. This represents approximately 400 hours of work spread over the 7 months of presence students.

Course contents

The principle of this option is based on project-based learning. The completion of the sustainable housing project should allow students to complete their training in the field. They will also have to train themselves on points that will not be covered in the lessons.

Skills developed through this course

- C1 : Design and prototype innovative systems that create value
  - C1C1 : Develop
    - Intermediate
    - Proficient
- C3 : Manage complex programmes or change responsibly
  - C3C1 : Design a project/programme
    - Intermediate
    - Proficient
- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - C4C1 : Build self-awareness, self-development
    - Intermediate
    - Proficient
- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Intermediate
    - Proficient
- C5 : Contribute to the development and deployment of a strategic corporate vision
  - C5C1 : Anticipate and commit
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Affordable and clean energy / Climate action / Decent work and economic growth / Gender equality / Goo health and well-being / Industry, innovation and infrastructure / Partnership s for the goals / Quality education / Reduced inequalities / Responsible consumption and production / Sustainable cities and communities

Sustainable Development and Social Responsibility Positioning

The project addresses sustainable development through the lens of frugality and social utility. Students collaborate with field partners (Kerlotec, Apala) to ensure the project meets a real need without creating technological dependency. The challenge is

to define specifications that minimize resource extraction from the very beginning of the design process.

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	6	0 hrs	0 hrs	0 hrs	136 hrs	0 hrs

Low-tech, ethical and responsible management [MALORE]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI

Requirements

Basic notions of management and project management

Objectives

This module offers a holistic approach to low-tech management, integrating skills in project management, agile methods, scientific research, collective intelligence, change management, ethics, and effective communication, with particular emphasis on visual and project indicators.

Course contents

- Introduction to low-tech management
- Project Management Basics
- Lean, Agile and Holacracy methods
- Introduction to scientific research
- Intelligence Collective
- That which accompanies change
- Responsible and ethical management
- Writing deliverables, visual management and project indicators

Course material

Aubry, C., Appert, E. (2019). L'art de devenir une équipe agile. (n.p.): Dunod.
Ballé, M., Beauvallet, G. (2020). Le management lean: Édition actualisée. France: Pearson.
Boussuat, B., Abgrall, L., Jaouën Kadi, V. (2022). Le Lean management en couleurs: Embarquez vos équipes vers une performance durable - méthode DISC-4Colors. (n.p.): Dunod.
Deslandes, G. (2012). Le management éthique. France: Dunod.
Laloux, F. (2024). Reinventing Organizations - Vers des communautés de travail inspirés. Canada: Tredaniel.
Lenhardt, V., Bernard, P. (2021). L'intelligence collective en action: Repères pour une co-construction du sens de l'entreprise. France: Pearson.
Sousa Cardoso, C. d., & Messina, J.-C. (2019). 121 outils pour développer le collaboratif: animer l'intelligence collective dans vos réunions, ateliers, séminaires. Eyrolles.

Skills developed through this course

- C3 : Manage complex programmes or change responsibly
  - C3C1 : Design a project/programme
    - Intermediate
    - Proficient
  - C3C2 : Manage/lead a project/programme
    - Intermediate
    - Proficient
  - C3C3 : Finalise and leverage feedback
    - Intermediate
    - Proficient
- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - C4C1 : Build self-awareness, self-development
    - Intermediate

- Proficient
- C4C2 : Promote individual and team performance
  - Intermediate
  - Proficient
- C4C3 : Lead transformation in one's organisation
  - Intermediate
  - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Decent work and economic growth / Gender equality / Goo health and well-being / Partnership s for the goals / Peace, justice and strong institutions / Quality education / Reduced inequalities

Sustainable Development and Social Responsibility Positioning

The course focuses on the social and governance pillars (Social Responsibility). It covers ethics, collective intelligence, holacracy, and inclusive management. Sustainable development is addressed through the lens of responsible management and the human support required to transition toward sober and resilient organizational models.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Low-tech design and manufacturing [COFALO]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI / Jérôme FRIANT

Requirements

Basic notions of design and manufacturing processes

Objectives

Discover a low-tech approach to design and manufacturing. Objectives include introducing 3D design with FreeCAD, exploring prototyping in Fablab, applying the Ashby method to choosing low-tech materials, redesigning common products, and implementing adapted welding, boilermaking and wood processes. Students will work on a concrete project, receive personalized support and present their achievements in a group, while understanding the economic and environmental advantages of the low-tech approach.

Course contents

- Introduction to low-tech design and prototyping
- Materials and choice according to the Ashby method
- Study and redesign of a commonly used product
- Implementation of welding / boilermaking / wood processes
- The wood material and its derivatives
- Engineering drawing and design
- Advanced prototyping in a Fablab
- Practical low-tech design and manufacturing project

Course material

Allwood, J. M., Cullen, J. M., (2012). Sustainable materials: with both eyes open. UIT Cambridge Limited.
Ashby, M. F. (2011). Matériaux et environnement: choix éco-responsable en conception. Dunod.
Ashby, M. F. (2012). Materials and the environment: eco-informed material choice. Butterworth-Heinemann Inc
Grosse, François (2010). Le découplage croissance / matières premières. De l'économie circulaire à l'économie de la fonctionnalité: vertus et limites du recyclage. Futuribles.

Skills developed through this course

- C1 : Design and prototype innovative systems that create value
  - C1C1 : Develop
    - Intermediate
    - Proficient
  - C1C2 : Dare
    - Intermediate
    - Proficient
  - C1C3 : Deliver and create value
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Climate action / Industry, innovation and infrastructure / Quality education / Responsible consumption and production

Sustainable Development and Social Responsibility Positioning

Here, SD is approached through technical implementation and material durability. The course deals with redesigning everyday products to make them simpler and more repairable, using low-impact materials, and leveraging FabLabs to foster technological appropriation and local manufacturing.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Ecological and low-tech housing [HABILO]

LEAD PROFESSOR(S): Emmanuel ROZIÈRE / Jean-Marc BEN GUIGUI

Requirements

Basic course in energy and materials

Objectives

This module aims to provide students with the knowledge and skills necessary to design, build, and renovate homes in a sustainable and ecological manner. Focusing on bioclimatic design, the use of local and eco-friendly materials, as well as the adoption of simple and self-sustaining technologies, this module trains students capable of creating resilient, resource-efficient and environmentally friendly homes, while promoting energy and water autonomy.

Course contents

- Bioclimatic design and sustainable architecture
- Local eco-materials for sustainable construction
- Eco-construction of resilient housing
- Renewable energy and energy efficiency for independent housing
- Building thermal
- Sustainable water management
- Ecological hygiene and sanitation
- Simple and appropriate building technologies and autonomous systems

Course material

Bodin, A. (2023). L'habitat permacole: guide pratique de la maison écologique et autonome inspirée par la permaculture. France: Editions Eyrolles.
Boudellal, M. (2011). Ecologique et autonome: Concevoir autrement son habitat. (n.p.): Dunod.
La Grange, C. (2013). La maison écologique: Penser et construire son habitat à moindre frais. France: Ed. de Terran.

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Intermediate
    - Proficient
  - C2C2 : Solve and arbitrate
    - Intermediate
    - Proficient
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Affordable and clean energy / Clean water and sanitation / Climate action / Responsible consumption and production / Sustainable cities and communities

Sustainable Development and Social Responsibility Positioning

This module focuses on the autonomy and technical resilience of housing. Environmental issues are at the heart of the content: bioclimatic design, use of local eco-materials, sustainable water management, and ecological sanitation. Practical examples include appropriate technologies such as rocket stoves and dry toilets.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Low-tech Project 2 [LOWTEC2]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI

Objectives

The realization of the sustainable housing project by the students with our partners Kerloc and Apala is broken down into modules of three times 136 hours over periods 1, 2 and 3. This represents approximately 400 hours of work spread over the 7 months of presence students.

Course contents

The principle of this option is based on project-based learning. The completion of the sustainable housing project should allow students to complete their training in the field. They will also have to train themselves on points that will not be covered in the lessons.

Skills developed through this course

- C1 : Design and prototype innovative systems that create value
  - C1C2 : Dare
    - Intermediate
    - Proficient
- C3 : Manage complex programmes or change responsibly
  - C3C2 : Manage/lead a project/programme
    - Intermediate
    - Proficient
- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - C4C2 : Promote individual and team performance
    - Intermediate
    - Proficient
- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C2 : Solve and arbitrate
    - Intermediate
    - Proficient
- C5 : Contribute to the development and deployment of a strategic corporate vision
  - C5C2 : Give meaning
    - Intermediate
    - Proficient

Skills assessed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - Intermediate
  - Proficient
- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - Intermediate
  - Proficient

Sustainable Development Goals (SDGs) covered by this course

Affordable and clean energy / Clean water and sanitation / Climate action / Decent work and economic growth / Gender equality / Goo health and well-being / Industry, innovation and infrastructure / No poverty / Partnership s for the goals /

Quality education / Reduced inequalities / Responsible consumption and production / Sustainable cities and communities / Zero hunger

Sustainable Development and Social Responsibility Positioning

The issue is addressed through eco-design. The goal is to select technical solutions that maximize the habitat's energy efficiency (thermal performance, fluid management) while using systems with reduced technological intensity. The students' responsibility lies in seeking solutions that are maintainable and repairable locally.

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	7	0 hrs	0 hrs	0 hrs	136 hrs	0 hrs

Sustainable housing and responsible territory [HABITE]

LEAD PROFESSOR(S): Emmanuel ROZIÈRE / Jean-Marc BEN GUIGUI

Objectives

This module aims to train students in the essential principles and practices of sustainability in housing and land use planning. Key points include intelligent waste management, adaptation to climate change, compliance with environmental certifications, promotion of sustainable mobility, integration of permaculture and biodiversity, low-tech planning of cities and territories , as well as understanding sustainable practices in forestry and agroforestry.

Course contents

- Waste management and circular economy
- Adaptation and resilience to climate change in a habitat
- Certification and environmental standards
- Sustainable and alternative mobility
- Permaculture, sustainable landscaping and biodiversity
- Low-tech city and territory
- Sustainable forestry and agroforestry
- Travel and meetings with stakeholders in eco-construction and sustainable housing

Course material

ADEME (2021). Villes low-tech: pour un urbanisme de discernement.
Deboudt, P. (2010). Inégalités écologiques, territoires littoraux & développement durable. France: Presses Universitaires du Septentrion.
Hervé-Gruyer, P., Hervé-Gruyer, C. (2021). Permaculture: guérir la terre, nourrir les hommes. France: Actes Sud.
Pattaroni, L., Kaufmann, V., Rabinovich, A. (2009). Habitat en devenir: enjeux territoriaux, politiques et sociaux du logement en Suisse. Suisse: Presses polytechniques et universitaires romandes.
Villes low-tech: pour un urbanisme de discernement. (2024). France: l'Institut Paris région.

Skills developed through this course

- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C1 : Represent and model
    - Intermediate
    - Proficient
  - C2C2 : Solve and arbitrate
    - Intermediate
    - Proficient
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Affordable and clean energy / Clean water and sanitation / Climate action / Life on land / No poverty / Reduced inequalities / Responsible consumption and production / Sustainable cities and communities / Zero hunger

Sustainable Development and Social Responsibility Positioning

This course examines the philosophical, political, and economic dimensions of SD. It explores the "commons", open-source models, responsible digital technology, and new sober business models. The analysis is holistic, questioning the engineer's role in society and the global impact of the electronics and industrial sectors.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Low-tech deepening [LORIZON]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI

Requirements

INGLOW - Low-Tech Engineering: Fundamentals and Practices

Objectives

This module aims to deepen students' understanding of essential aspects of low-tech engineering. It focuses on feedback, responsible communication, low-tech philosophy, history of techniques, low-tech business and entrepreneurial models, responsible digital, industry and low-tech perspective. -electronics tech. Students will be better equipped to integrate these elements into their engineering approach, thus promoting a holistic and sustainable vision.

Course contents

- Feedback, Capitalization and Knowledge Sharing
- Responsible communication
- Low-tech philosophy and engineering ethics
- The history of techniques and low-tech
- Low-tech Business Model and Low-tech Entrepreneurship
- Low-tech and responsible digital
- Industry and low-tech
- Low-tech electronics

Course material

Atelier Paysan. (2021). Reprendre la terre aux machines: manifeste pour une autonomie paysanne et alimentaire. France: Éditions du Seuil.
Crawford, M. B. (2016). Éloge du carburateur: Essai sur le sens et la valeur du travail. France: La Découverte.
Crawford, M. B. (2019). Contact: pourquoi nous avons perdu le monde, et comment le retrouver. France: La Découverte.
Ellul, J. (1988) Le bluff technologique.
Franklin, U. (1989). The Real World of Technology.
Fustec, A. (2024). La stratégie du Y.
Illich, I., Giard, L., & Bardet, V. (1973). La convivialité. Editions du Seuil.
Jarrige, F. (2016). Technocritiques: Du refus des machines à la contestation des technosciences. Canada: La Découverte.
Jevons, W. (1865). The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal Mines.
Mateus, Q., Roussilhe, G. (2023). Perspectives low-tech: comment vivre, faire et s'organiser autrement ?. France: Éditions Divergences.
Mumford, L. (1966). Le Mythe de la machine, technique et développement humain.
Schumacher, E. (1973). Small is Beautiful: A Study of Economics As If People Mattered.
Gaillard Clément. (2023). Une anthologie pour comprendre les Low-Tech.

Skills developed through this course

- C3 : Manage complex programmes or change responsibly
  - C3C3 : Finalise and leverage feedback
    - Intermediate
    - Proficient
- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - C4C1 : Build self-awareness, self-development
    - Intermediate
    - Proficient
  - C4C2 : Promote individual and team performance
    - Intermediate
    - Proficient
  - C4C3 : Lead transformation in one's organisation
    - Intermediate
    - Proficient
- C5 : Contribute to the development and deployment of a strategic corporate vision
  - C5C1 : Anticipate and commit
    - Intermediate
    - Proficient
  - C5C2 : Give meaning
    - Intermediate
    - Proficient
  - C5C3 : Develop and sustain
    - Intermediate
    - Proficient

Skills assessed through this course

No skill observed

Sustainable Development Goals (SDGs) covered by this course

Affordable and clean energy / Climate action / Decent work and economic growth / Gender equality / Goo health and well-being / Industry, innovation and infrastructure / No poverty / Partnership s for the goals / Reduced inequalities / Responsible consumption and production / Sustainable cities and communities / Zero hunger

Sustainable Development and Social Responsibility Positioning

This course examines the philosophical, political, and economic dimensions of SD. It explores the "commons", open-source models, responsible digital technology, and new sober business models. The analysis is holistic, questioning the engineer's role in society and the global impact of the electronics and industrial sectors.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Low-tech Project 3 [LOWTEC3]

LEAD PROFESSOR(S): Jean-Marc BEN GUIGUI

Objectives

The realization of the sustainable housing project by the students with our partners Kerloc and Apala is broken down into modules of three times 136 hours over periods 1, 2 and 3. This represents approximately 400 hours of work spread over the 7 months of presence students.

Course contents

The principle of this option is based on project-based learning. The completion of the sustainable housing project should allow students to complete their training in the field. They will also have to train themselves on points that will not be covered in the lessons.

Skills developed through this course

- C1 : Design and prototype innovative systems that create value
  - C1C3 : Deliver and create value
    - Intermediate
    - Proficient
- C3 : Manage complex programmes or change responsibly
  - C3C3 : Finalise and leverage feedback
    - Intermediate
    - Proficient
- C4 : Manage multidisciplinary and multicultural programme or project teams ethically and responsibly
  - C4C3 : Lead transformation in one's organisation
    - Intermediate
    - Proficient
- C2 : Analyse a complex system from all angles (scientific, economic, human, social) and propose a solution
  - C2C3 : Think and act in an unpredictable and uncertain environments
    - Intermediate
    - Proficient
- C5 : Contribute to the development and deployment of a strategic corporate vision
  - C5C3 : Develop and sustain
    - Intermediate
    - Proficient

Skills assessed through this course

- C1 : Design and prototype innovative systems that create value
  - Intermediate
  - Proficient
- C3 : Manage complex programmes or change responsibly
  - Intermediate
  - Proficient
- C5 : Contribute to the development and deployment of a strategic corporate vision
  - Intermediate
  - Proficient

Sustainable Development Goals (SDGs) covered by this course

Affordable and clean energy / Clean water and sanitation / Climate action / Decent work and economic growth / Gender equality / Goo health and well-being / Industry, innovation and infrastructure / No poverty / Partnership s for the goals / Quality education / Reduced inequalities / Responsible consumption and production / Sustainable cities and communities / Zero hunger

Sustainable Development and Social Responsibility Positioning

The project culminates in a concrete achievement that embodies territorial resilience. The sustainability aspect is managed through materials management (use of bio-sourced or reused materials) and social responsibility via open-source documentation. This transforms an individual solution into a reproducible "common good," fostering technical education and collective autonomy.

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	8	0 hrs	0 hrs	0 hrs	136 hrs	0 hrs