SKILLS
INSTRUCT
INSTRUMENTS
CONSTRUCTION

Delivering Skills and Definition of Qualifications through Learning Outcomes Matrix in the EU

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D2.3 Delivering Skills and Definition of Qualifications through Learning Outcomes Matrix in the EU

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Disclaimer:

Table of contents

List of figures:

List of tables:

Glossary

Acronym	Full name
CA	Consortium Agreement
EC	European Commission
EASME	The Executive Agency for Small and Medium-sized Enterprises
GA	Grant Agreement
PC	Project Coordinator
WP	Work Package
TL	Task Leader
DoA	Description of Action
PSC	Project Steering Committee
SQM	Scientific and Quality Manager
DEC	Dissemination and Exploitation Committee
KOM	Kick-off meeting
ASM	ASM – Market Research and Analysis Centre
VTT	Technical Research Centre of Finland
LIST	Luxembourg Institute of Science and Technology
RIL	Finnish Association of Civil Engineers
CU	Cardiff University
R2M	Research to Market Solution France
DTTN	Distretto Tecnologico Trentino
ENEFFECT	Center for Energy Efficiency EnEffect
GER	General Exploitable Result
AB	Advisory Board
PM	Person month
M	Month
EE	Energy Efficiency

Executive Summary

There is strong evidence that supports the correlation between training and energy efficiency in the construction industry (Barbero et. Al, 2022), reinforcing the need for the adoption of an EU wide framework to train the European workforce. Launched in 2008 as a 'Common Reference Framework', including eight levels oflearning and three descriptors that aimed at providing a 'translation grid' between national qualifications, the European Qualifications Framework (EQF) aims at numerous educational reforms such as promoting the learning outcomes orientation, transparency of qualifications and fostering mobility across national borders, employment sectors and educational sectors (Bohlinger 2019).

The objective of this report is to define the qualifications (i.e. learning outcomes) for energy efficiency informed by (a) the understanding of the correlation between training and energy efficiency, and (b) the training landscape for energy efficiency across Europe. These learning outcomes are benchmarked between the countries involved in the INSTRUCT project (France, Finland, Luxembourg, Poland, and United Kingdom), extended to other European countries using the INSTRUCT Stakeholders Network. The report uses the European level learning outcomes for the following roles along with the related **EQF levels:**

- Client & Clients advisors, specifically: Client, Project manager, Energy manager, Energy coordinator, Briefing consultant.
- Architectural design roles, specifically: Architectural Design and Energy Coordinator, Chief Designer, Architect, Assistant designer.
- Structural design roles, specifically: Structural design and Energy coordinator (structural), Assistant designer.
- Building services design roles, specifically: HVAC and Energy design and Energy coordinator (HVAC), Assistant designer.
- Construction work roles, specifically: Site manager, construction site workers and installers.
- Maintenance work roles, specifically: Maintenance operator, property manager, care taker.

Learning outcomes are defined in specific order forming eight groups:

- Basic general knowledge of sustainable energy interventions and principles and their application across lifecycle and supply-chains
- Basic factual knowledge of sustainable and energy-efficient buildings and building performance.
- Knowledge of facts, principles, processes and general concepts on building energy efficiency
- Factual and theoretical knowledge on energy efficiency, sustainability and building performance
- Comprehensive, specialised, factual and theoretical knowledge on energy efficiency, sustainability and building performance
- Advanced knowledge in energy efficiency, involving a critical understanding of theories and principles
- Highly specialised knowledge in energy efficiency.
- Knowledge at the most advanced frontier of energy efficiency and at the interface between related disciplines

It is worth noting that while the learning outcomes include requirements about performance-based building, with a focus on factors with direct and indirect impacts on energy efficiency, other important performance related aspects should not be overlooked.

Chapter 1. Introduction

The European Qualifications Framework (EQF) is a common European reference framework with the objective to make qualifications clearer across European countries and systems. The implementation of the EQF was based on the Recommendation on the European Qualifications Framework for lifelong learning adopted by the European Parliament and the Council on 23 April 2008.

Covering qualifications at all levels and in all sub-systems of education and training, the EQF provides a comprehensive overview over qualifications in European countries currently involved in its adoption. The core of the EQF, as illustrated in Table 1, is its eight reference levels defined in terms of learning outcomes, i.e. knowledge, skills and autonomy-responsibility. Learning outcomes express what individuals know, understand and are able to do at the end of a learning process. Countries develop national qualifications frameworks (NQFs) to implement the EQF.

The EQF was influenced by work conducted in countries such as Australia, Scotland, New Zealand and South Africa (Haut Comité éducation-économie-emploi 2004) who have pioneered the concept of NQF (Bohlinger, 2019). Conversely, the EQF originated from a wide consultation with experts, policymakers and a wide range of studies including work commissioned by the European Commission whichprovided the fundament for the level descriptors (Coles and Oates, 2004; Winterton, Delamare-Le Deist, and Stringfellow 2006) and the OECD work on 'The Role of National Qualifications Systems in Promoting Lifelong Learning' (Behringer and Coles 2003; Bohlinger 2019).

It is worth noting that several scholars had questioned if qualifications frameworks in general and the EQF in particular would be able to meet the expectations that had emerged from its development under economic and political pressure (Bohlinger 2019; Allais 2007; Allais et al. 2009; Bohlinger 2007–08; Ensor 2003; Keating 2003; Keevy 2005; Young 2003, 2007). Moreover, scholars have highlighted the difficulty of assimilating and benchmarking important concepts related to education systems across national borders − a prerequisite for developing qualifications frameworks. Despite concerns raised at a national level, by the end of 2013, 16 EU Member States had completed the EQF process (ICF GHK 2013, 44). In 2017, 39 countries including all 28 EU Member states plus another 11 countries (Albania, Bosnia–Herzegovina, Iceland, Kosovo, Lichtenstein, Montenegro, Norway, Serbia, Switzerland and Turkey) had adopted the recommendation, and 34 of Them had finished the process in 2018 (Cedefop 2018, 35). When the European Commission celebrated the EQF's 10th anniversary in the same year (in March 2018), it published a communication highlighting the advantages resulting from the EQF.

Reflecting the success in implementing the 2008 recommendation, a revised and strengthened Recommendation on the EQF was adopted on 22nd May 2017 by the Education, Youth, Culture and

Sport Council (Bohlinger 2019). The purpose of this revised recommendation is to ensure the continuity as well as a further grounding of the EQF (see Figure 1).

	2008 EQF recommendation	2017 EQF recommendation
Learning outcomes	Statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence.	Statements regarding what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and responsibility and autonomy.
Knowledge	Outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual.	
Skills	Ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive or practical.	
Competence	Proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the EQF, competence is described in terms of responsibility and autonomy.	Proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development.
Autonomy and responsibility		Means the ability of the learner to apply knowledge and skills autonomously and with responsibility.

Figure 1 Level EQF Level Descriptors 2008 and 2017 (Source: Bohlinger, 2019)

The objective of this report is to define the qualifications (i.e. learning outcomes) for energy efficiency informed by (a) the understanding of the correlation between training and energy efficiency, and (b) the training landscape for energy efficiency across Europe. These learning outcomes will then be compared between the countries involved in the partnership (France, Finland, Luxembourg, Poland, and United Kingdom), extended to other European countries using our INSTRUCT Stakeholders Network. As such, the identified roles and skills will be analysed according to the EQF (European Qualification Framework), and a full list will be established taking into account the screening and benchmarking of existing training institutions. The different topics will be described according to the required learning outcomes (knowledge, skills and competences), leading to a learning outcomes matrix. The learning outcomes will be described according to the EQF recommendations. The learning outcomes can be grouped in basic units: a unit of learning outcome is a component of a qualification consisting of a coherent set of knowledge, skills and competence that can be assessed and validated. The learning outcomes will also be formulated according to the EQF recommendations (use of active verbs, parsimonious and comprehensible formulations). The learning outcomes matrix depends on the qualification level. In this report, we target all existing levels (from 1 to 8) applied to energy efficiency in the Construction sector. Furthermore, there is a first attempt to create profiles for each professional role, based on the definitions for knowledge, skills, and autonomy and responsibility.

Chapter 2. Background

2.1 Learning Outcomes

Learning outcomes are the explicit statements of what a learner is expected to know, understand and is able to do after the completion of a learning activity. Learning outcomes discussed in this report refer to the intended leaning outcomes (ILOs) rather than achieved learning outcomes (ALOs). Learning-outcomes-based frameworks enable the comparison of qualifications across different types of institutions and stakeholders. By providing a common language makes it possible to compare qualifications over national borders.

"Learning outcomes are attributed to individual educational components and to programmes at a whole. Learning outcomes are specified in three categories – as knowledge, skills and competence. This signals that qualifications – in different combinations – capture a broad scope of learning outcomes, including theoretical knowledge, practical and technical skills, and social competences where the ability to workwith others will be crucial." (Users' Guide, 2015)

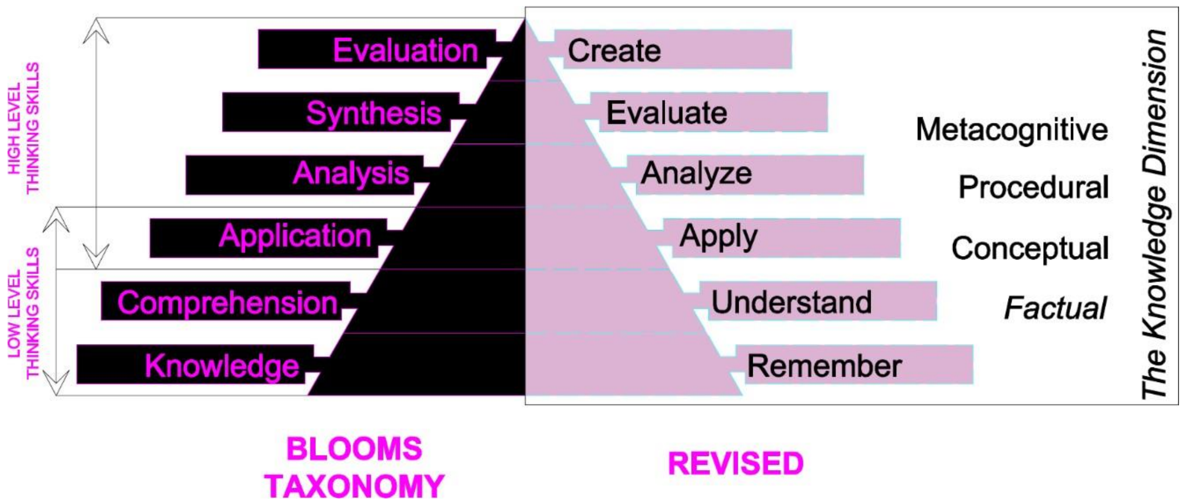

Figure 2 Bloom's taxonomy and revised Bloom's taxonomy hierarchical levels

Learning outcomes are valuable. Bloom's taxonomy and revised Bloom's taxonomy are the most often used frequent tools while developing learning outcomes. The cognitive domain of the Taxonomy comprises of six hierarchical levels of learning. The categories are ordered form simple to complex and from concrete to abstract (Krathwohl, 2002) with a focus towards the level of cognitive processing required in the levelsof learning particularly termed as low level thinking skills (LOTS) and high level thinking skills (HOTS) as shown in Figure 2.

2.2 EU-wide intended learning outcomes

The following process (Figure 4) was used in development of harmonized EU-wide learning outcomes First, BIM EE Roles/Responsibilities (R, R2) are identified. Skills (S), Knowledge (K), Competences (C) and Learning Outcomes (LO) are defined for the different roles in design and building and maintenance process by partners from their country perspective (France, Finland, Greece, Luxembourg and United Kingdom). Then all deliveries produced during BIMEET and other relevant EU-projects are mapped. Results of the same elements (R2, SKC and R (Roles) are collected and stored in Super Matrix. The first draft of EU-wide Learning Outcome Matrix is produced after the assessment of the most important and relevant learning outcomes. The so produced learning outcomes are then validated within the consortium and validated with the help of the expert panel of the project resulting to the final product of D2.3.

The basic structure of learning outcomes statements…			
… should address the learner.	… should use an action verb to signal the level of learning expected.	… should indicate the object and scope (the depth and breadth) of the expected learning.	... should clarify the occupational and/or social context in which the qualification is relevant.
Examples			
The student…	…is expected to present …	…in writing the results of the risk analysis	….allowing others to follow the process replicate the results.
The learner…	…is expected to distinguish between…	…the environmental effects…	…of cooling gases used in refrigeration systems.

Figure 3 Basic structure of the learning outcomes (Source: Cedefop, 2018)

The approach adopted to describe and develop EU wide learning outcomes is based on the principles of the EQF particularly focusing on the KSC framework and the use of action verbs in relation to what a learner should know, have skills and be competent on. An example showing the basic structure of learning outcomes are presented in the Figure 3.

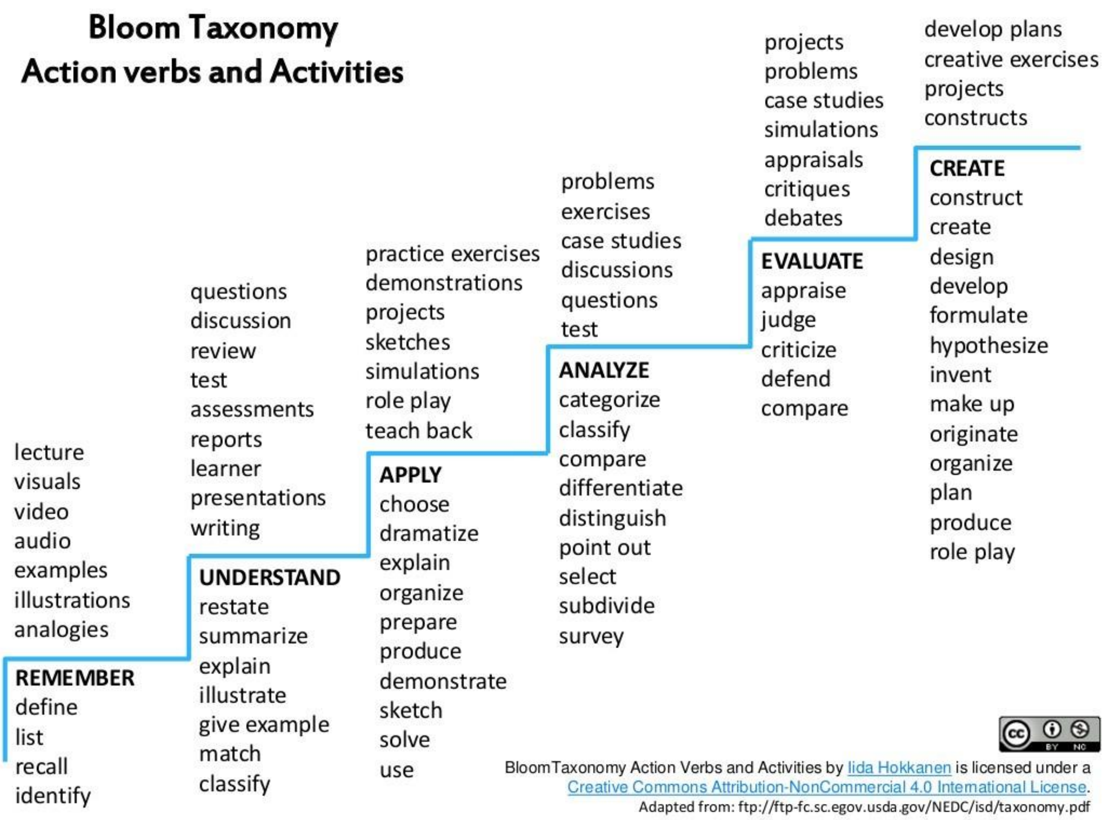

Figure 4 Bloom taxonomy action verbs and activities (Source: Hokkanen, 2015)]

The process used to develop the learning outcomes furthermore also relates to the case based approach. It focuses on mapping the standard RIBA Plan of Work stages and identified stakeholders followed by the process to defining learning outcomes for the role based courses. The three categories of KSC should be collectively perceived and should not be read in isolation from each other. Figure 4 and 4 highlights some of the action verbs used to define the levels of taxonomy in the cognitive domain.

Furthermore, in the context of the revised version for the EQF, the following definitions (descriptor defining levels) are proposed: “a. ‘Knowledge’ means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the EQF, knowledge is described as theoretical and/or factual, b. ‘skills’ means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments), c. ‘responsibility and autonomy’ means the ability of the learner to apply knowledge and skills autonomously and with responsibility, d. ‘competence’ means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development.” (EUR-Lex.europa.eu, 2017), The revised version of the EQF replaced the term competence, which was present in the previous version of 2008, with autonomy and responsibility (Bohlinger, 2019). For the purposes of this study these definitions are used as a basis of communication to gain deeper insight in the learning outcomes and to create profile (roles) tables, as they emerge from the consultations with the INSTRUCT consortium of experts within the construction sector in the EU.

Chapter 3. Methodology

From a theoretical point of view, the study follows a pragmatic approach. Pragmatism has as its main principles that practical outcomes, and empirical research are prioritised in assessing knowledge, while there is not only one way to approach a problem, and the traditional dualisms should not be limiting to the research process (Denscombe, 2010). Outcomes that support action are the ones that pragmatism is interested it, and a combination between qualitative and quantitative approaches is therefore accepted. The study continuously reflected on the received data, and updated its approach, to integrate and reflect on the new information and elaborate on ways to proceed. For this purpose, a three-stage methodology was followed (as seen in Figure 1):
PHASE 1: Collection, documentation and formation of Learning Outcomes Matrix
PHASE 2: Validation of Learning Outcomes from ongoing process of pilots and inference of new outcomes
PHASE 3: Consolidation of outcomes and updated versions

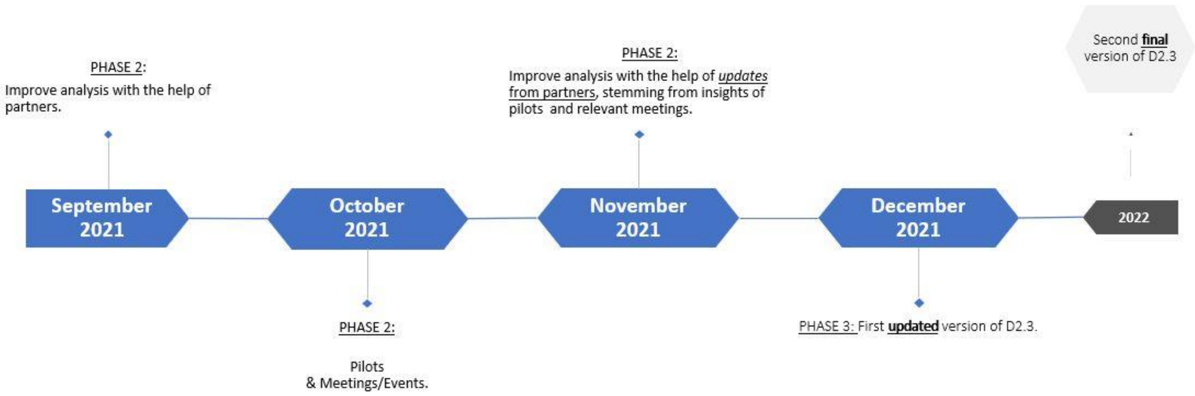

Figure 5 Three - Stage Methodology

For Phase 1, the most complete and representative Matrix tables that were collected were consulted and included in the first version of the Learning Outcome study. The outcomes were presented in tables, which correspond to the six roles: Client & Clients advisors, Architectural design roles, Structural design roles, Building services design roles, Construction work roles, Maintenance work roles. For Phase 2, the matrices were released back to the INSTRUCT partners as a first step to ask for comments and updates on the matrix tables. After that, and in the context of 8 pilots taking place in 5 geographical clusters across Europe (Figure, within the context of the INSTRUCT project, insights were also integrated to further populate the matrices and update the learning outcomes. Lastly, for Phase 3, which is yet to be completed, what is expected is the finalisation of the matrix tables, after the integration of insights from the pilot process.
For the creation of the template for the learning outcome matrices, a process of integrating deliveries from the BIMEET and EU-projects was followed, by looking into BIM EE Roles/Responsibilities, and

defining skills, knowledge and competences, as descriptors defining levels in EQF. The spectrum of different roles in the construction value chain was also taken into consideration, by consulting partners' perspective (France, Finland, Greece, Luxembourg and United Kingdom). In order to define what the learner should know for each descriptor and level, a list of action verbs was also consulted by taking into account the Bloom's taxonomy list of verbs, such as: "remember", "understand", "apply", "analyse", "evaluate", "create" (Hokkanen, 2015). Furthermore, all 8 levels proposed by the EQF were taken into consideration, to create a hierarchy of desirable learning outcomes.

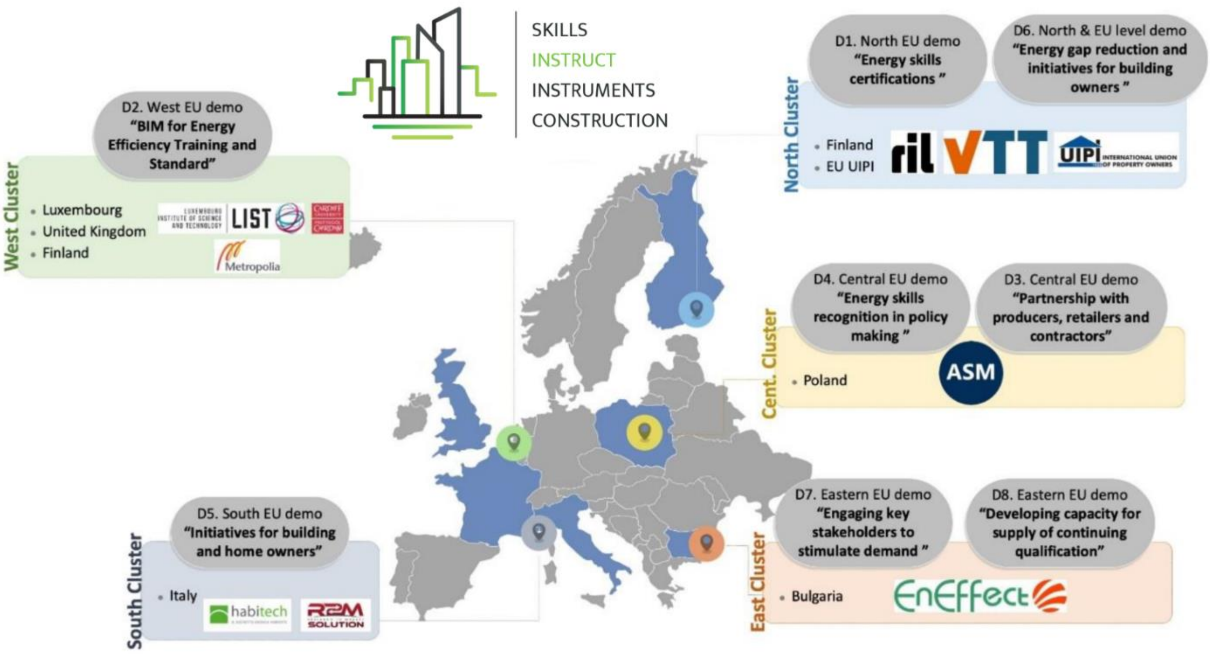

Figure 6 Overview of the demonstration pilots (Source: INSTRUCT, 2021)

Chapter 4. Results: Phase 1

The work resulted in proposing 6 - 8 specified groups of learning outcomes for the each selected main category role (Table 1 - Table 6). Each of the groups consists of 4 - 14 learning outcomes that clarify and supplement the required qualifications. Tables 6 - 12 present the European level learning outcomes for the following roles along with the related EQF levels:

We use the European level learning outcomes for the following roles along with the related EQF levels:

- Client & Clients advisors, specifically: Client, Project manager, Energy manager, Energy coordinator, Briefing consultant (Table 1)
- Architectural design roles, specifically: Architectural Design and Energy Coordinator, Chief Designer, Architect, Assistant designer (Table 2)
- Structural design roles, specifically: Structural design and Energy coordinator (structural), Assistant designer (Table 3)
- Building services design roles, specifically: HVAC and Energy design and Energy coordinator (HVAC), Assistant designer (Table 4)

- Construction work roles, specifically: Site manager, construction site workers and installers (Table 5)
- Maintenance work roles, specifically: Maintenance operator, property manager, care taker (Table 6)

Learning outcomes are defined in specific order forming eight groups:

- Group 1 (LO1) Basic general knowledge of sustainable energy interventions and principlesand their application across lifecycle and supply-chains
- Group 2 (LO2) Basic factual knowledge of sustainable and energy-efficient buildings and building performance.
- Group 3 (LO3) Knowledge of facts, principles, processes and general concepts on building energy efficiency
- Group 4 (LO4) Factual and theoretical knowledge on energy efficiency, sustainability and building performance
- Group 5 (LO5) Comprehensive, specialised, factual and theoretical knowledge on energy efficiency, sustainability and building performance
- Group 6 (LO6) Advanced knowledge in energy efficiency, involving a critical understanding of theories and principles
- Group 7 (LO7) Highly specialised knowledge in energy efficiency.
- Group 8 (LO8) Knowledge at the most advanced frontier of energy efficiency and at the interface between related disciplines

Table 1: European EE learning outcome matrix for Client & Client advisors i.e. Client &Project manager, manager, coordinator, briefing consultant.

No	**Table 1:** Country specific learning outcome and qualifications	EQF LEVEL			
Client & Client advisors Client & Project manager (C), Energy manager (EM), Energy coordinator (BC), briefing consultant (Bc)		C	EM	EC	Bc
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**4**	**5**	**5**	**5**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	5	5	4
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	2	3	3	3
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	3	3	3

LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**6**	**6**	**6**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	2	3	2	2
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	2	4	4	2
2.3	Explain relations between life-cycle costs, energy performance and building performance.	2	3	3	2
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**2**	**2**	**2**	**2**
3.1	Learner is able to use relevant energy target-setting tools.	2	2	2	2
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**2**	**3**	**3**	**2**
4.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	2	3	3	2
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**2**	**3**	**3**	**2**
5.1	Learner is able to explain and use energy production/consumption methods.	3	4	4	3
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**	**2**	**2**
6.1	Learner is able to use tools such as energy management software.	2	2	2	2

Table 1 European EE learning outcome matrix for Client & Client advisors i.e. Client & Project manager, manager, coordinator, briefing consultant.

Table 2: European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH),Assistant designer (ASS)

No	**Table 2:** Country specific learning outcome and qualifications	EQF LEVEL		
	Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer (CD),Architect (ARCH), Assistant designer (ASS)	CD	ARCH	ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	6	6	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	6	6	5

1.3	Summarize the ideas of digital space and asset management.	6	6	6
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**5**	**5**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	6	5	5
2.2	Distinguish the level of passive performance	6	6	6
2.3	Understand and know the 4 performance criteria	6	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**4**
3.1	Learner is able to understand and describe how to capitalize on passive energy gains.	5	5	4
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**4**	**4**	**3**
4.1	Learner is able to use relevant energy target-setting tools.	4	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**6**	**6**	**5**
5.1	Learner is able to explain and use energy production/consumption methods.	6	5	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**6**	**6**	**6**
6.1	Identify the services, methodologies (BIM) and people to constitute an operational team	6	6	6
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**6**	**6**	**6**
7.1	Master the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.	6	6	6
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains.**	3	3	2
8.1	Understand how to drastically reduce the losses of buildings.	6	5	5

Table 2 European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)

Table 3. European wide EE learning outcome matrix for structural design roles i.e.Structural design and coordinator (structural), Assistant designer

No	**Table 3:** Country specific learning outcome and qualifications	EQF Level		
Structural design roles Structural engineering design Magister (SED), Construction Management (Bachelor), Project Management in Construction (Master)		SED	CM	PMC
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	-	-	-
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	4	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	3	4	5
1.3	Summarize the ideas of digital space and asset management.	2	2	2
1.4	Explain the added value of using energy model open file formats to ensure interoperability.	2	2	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3	4
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	-	-	-
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	4	5	6
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	4	5	6
2.3	Explain relations between life-cycle costs, energy performance and building performance.	5	5	6
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	4	4	5
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	3	3	4
2.6	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	4	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	-	-	-
3.1	Explain the overall design process for energy-efficient building.	3	4	5

3.2	Assist client to set realistic and achievable energy and building performance target.	3	4	5
3.3	Perform preliminary energy analysis in the early project stages for both new and renovation projects to add value for the decision making.	4	4	5
3.4	Assist the client to set and specify information requirements.	4	4	5
3.5	Explain how to support owner's effective decision-making and opinion formation of other stakeholders.	4	4	5
3.6	Illustrate how to direct the design towards set targets utilizing the capacity of different kinds of assessment methods relevant for building construction design.	5	5	6
3.7	Explain the flow of design teamwork and demonstrate how to prepare, compare and improve alternative concepts.	5	5	6
3.8	Lead / assist the tasks related to technical documents for the building authorities.	6	5	6
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	-	-	-
4.1	Apply the set performance targets related to building design into BIM-based design process.	4	4	4
4.2	Iterate the design solutions to meet the set targets of building performance and energy efficiency.	4	4	4
4.3	Consider options of renewable energy and optimize its potentials.	3	3	4
4.4	Create different energy efficient design concepts renewable energy systems.	3	4	4
4.5	Perform energy analyses including dynamic simulations.	2	2	2
4.6	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2	2	2
4.7	Perform lightning calculations, analyses and simulations.	2	2	2
4.8	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4	5	5
4.9	Use life cycle cost calculation including life-cycle studies changing influential design parameters.	5	4	5
4.10	Share the results of energy simulations, discuss the options and update domain BIMs.	4	3	4
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	-	-	-
5.1	Prepare the Construction engineer's domain model on the basis of set targets and definitions given in architect's domain model.	6	3	4

5.2	Create and update digital (BIM-linked) building specification with material and dimensional information to reflect owner's quality and performance requirements.	4	3	4
5.3	Explain essential issues of the needs of initial information and the potentials of different inventory surveys in refurbishment projects.	5	4	5
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4
5.5	Prepare/assist information needed for specific use cases such as bill of quantities.	6	5	6
5.6	Prepare/assist the domain model for simulation and assessment.	5	4	5
5.7	Prepare/assist models and information for planning authority and in required data format.	4	3	4
5.8	Prepare/assist models and information for procurement and construction.	5	4	5
5.9	Prepare models to fulfil quality and information requirements for quality control and assurance processes in construction.	5	4	5
5.10	Prepare models based on data and information requirements of sustainable care and maintenance processes.	4	4	5
5.11	Prepare information for As-Built Models and Maintenance model for utilization of client and building management.	4	4	5
5.12	Prepare/assist in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performance requirements.	5	4	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	-	-	-
6.1	Describe the essential parts of the procedure for BIM based collaboration.	4	4	5
6.2	Describe different collaborative interdisciplinary and open BIM working methods, tools and processes.	4	4	5
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	4	4	5
6.4	Prepare relevant visualization models to enable information sharing, decision making and opinion formation.	5	4	5
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	6	5	6
6.6	Collaborate with the help of communication platforms and processes.	6	5	6
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	-	-	-

7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	4	3	4
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	4	3	4
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant forbuilding construction design.	5	3	4
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	5	4	5
7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	4	3	4
7.6	Instruct and audit contractors on construction site on critical points.	6	4	5
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	4	3	4
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	-	-	-
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	6	4	4
8.2	Use relevant energy design calculations and assessment tools in different design phases.	2	3	3
8.3	Use different tools for BIM-based collaborative working.	5	4	5
8.4	Create combination model and use model checking tools for clash detection.	4	3	4
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	3	3	4
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	5	3	4

8.7	Prepare the domain model for simulation and assessments	4	3	4
8.8	Use tools for environmental impact analyses.	3	3	4
8.9	Use project data and file management systems.	5	4	5

Table 3 European wide EE learning outcome matrix for structural design roles i.e. Structural design and coordinator (structural), Assistant designer

Table 4. European EE learning outcome matrix for building service design roles i.e. HVACand energy design and coordinator (HVAC), assistant designer

No	**Table 4:** Country specific learning outcome and qualifications	EQF Level	
Building services design roles HVAC and energy design (HVAC+E) and Energy coordinator (HVAC), assistant designer (ASS)		HVAC +E	ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	7
1.2	Know the health and economic issues related to good IAQ.	7	7
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**
2.1	Know the regulations regarding IAQ and ventilation in buildings.	6	6
2.2	Know the rules for the design, sizing and implementation of a residential ventilation system.	6	6
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**4**	**3**
3.1	Know the keys to a successful ventilation and IAQ audit.	5	5
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**3**	**3**
	Know the principles of measurement, methods of analysis, measurement	4	3

4.1	protocols and sampling methods.		
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**3**	**2**
5.1	Find avenues for improving IAQ.	5	4
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**
6.1	Know the methods of managing indoor air quality.	5	5

Table 4 European EE learning outcome matrix for building service design roles i.e. HVAC and energy design and coordinator (HVAC), assistant designer

Table 5. European wide EE learning outcome matrix for Construction work roles i.e. Sitemanager, Construction site workers and installers

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**4**
1.1	Acquire the basics of efficient rehabilitation.	6	6
1.2	Know the keys to renovating an existing building at low consumption level.	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**4**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	5
No	Table 5: Country specific learning outcome and qualifications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**

1.1	Acquire the basics of efficient rehabilitation.	6	6
1.2	Know the keys to renovating an existing building at low consumption level.	6	5
1.3	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	5	4
1.4	Explain added value of sustainable energy efficient practices and sustainable projects.	4	4
1.5	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**3**	**2**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	4
2.3	Understand the benefits of effective rehabilitation and its opportunities for professionals.	5	5
2.4	Understanding and application of new working methods, regulations and outlooks on effective rehabilitation.	4	4
LO3	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**4**
3.1	Explain the importance efficient rehabilitation and low consumption level.	**5**	**5**
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**
4.1	Know the principles of measurement, methods of analysis of heat low from buildings. (LO6?)	**5**	**5**
4.2	Know the principles of organization of spaces, ventilation, air tightness and humidity management. (LO6?)	**5**	**5**
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**	**5**	**5**
5.1	Know the principles of wall insulation, thermal bridges and thermal comfort.	**5**	**5**
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**4**	**4**
6.1	Know the principles of heating and domestic hot water and lighting and electrical equipment specifically in old houses.	**4**	**4**

Table 5 European wide EE learning outcome matrix for Construction work roles i.e. Site manager, Construction site workers and installers

Table 6. European EE learning outcome matrix for Maintenance work roles i.e.Maintenance operator, Property manager, Care taker

No	**Table 6:** Country specific learning outcome and qualifications	,EQF Level		
Maintenance work roles	Maintenance operator (MO), Property manager (PM), Care taker (CT)	MO	PM	CT
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Knowing how to identify the needs and challenges of the co-ownership in terms of renovation.	6	6	5
1.2	Acquire the basics of renovation and energy performance.	6	6	5
1.3	Know the different stages of a renovation project.	6	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**	**6**
2.1	Evaluate the potential of the co-ownership and be able to unite around the issue of renovation.	5	4	4
2.2	To be able to collect the data necessary for the good start of the project and to know how to use an audit.	5	5	4
2.3	Understand the different roles of each: Syndic, union council, AMO, ...	6	6	5
2.4	Know how to order a quality project management.	6	6	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**5**
3.1	Know the different types of financing and be able to express yourself on this subject.	5	5	4
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**	**5**
4.1	Know how to mobilize before the general assembly.	5	5	5
4.2	Know the procedure to follow for a calm and legally unchallengeable vote on the work.	5	5	4
4.3	To be able to follow the work: understand the role of each person and ensure the proper conduct of the site.	5	5	4

Table 6 European EE learning outcome matrix for Maintenance work roles i.e. Maintenance operator, Property manager, Care taker

Chapter 6. Results: Demonstration Pilot Custers: Phase 2 & 3

In this section, the development of the Learning Outcomes Matrices is presented, following Stage One. As described in the Methodology section, in this stage,the INSTRUCT partners were consulted and are still being consulted, in order to provide any useful insights which stem from the demonstration pilots. The updates are structured into sections which reflect the European clusters and the specific partners, in the Appendix of the Extended version of the Deliverable.

Chapter 7. Phase Three

a. the first stage which includes gathering the inputs from the partners' contributions stemming from the demos and producing an updated set of Learning Outcomes Matrices
b. the final stage which includes combining all the stages, in order to produce a new and final set of Learning Outcomes Matrices

7.1 Phase Three: First & Second Stage

The first stage of the third phase of eliciting new Learning Outcomes for the Matrices included a two-stage methodology, with the intent to:

a. Facilitate the dissemination and elicitation of useful inputs from partners
b. Provide a tailored approach to each demo, based on the country's context and different approach used by each partner
c. Make sure that different inputs were gathered at different stages and different target groups were targeted. For example for the second stage, only experts/trainers were consulted in order to make sure their contributions were based on their extensive and focused expertise

This methodology was a result of brainstorming between consortium partners of the INSTRUCT project, during meetings. The questions to be us were given to consortium members to provide feedback and commentary/changes. After this stage, the final list of questions was formulated and established.
Overall, for this phase the following partners were consulted:

1. RIL
2. EnEffect
3. Cardiff University
4. DTTN
5. LIST
6. R2M (supporting role in assisting DTTN-not leading)

The two-stage methodology is as follows:
WP4 involves 5 real-world Demonstration projects that aim at evidencing the usefulness and ease of use of our instruments for recognition of energy skills and qualifications. It was agreed that WP4 could

also serve as a basis for inferring new learning outcomes, in line with Task T2.3. In that respect, a two-stage methodology is proposed:

(a) Stage 1: Inferring skill gaps, training needs, and related learning outcomes across the 5 value chains associated with our demonstration projects

(b) Stage 2: Interviews with training providers across participating countries to (i) validate existing learning outcomes and their EQF Level, and (b) propose new learning outcomes informed by outcomes from Stage 1 consultation. These are further elaborated below.

<u>Stage 1: Engaging with the Local value chains</u>

The questions that need discussing with each value chain (across the 5 demonstration projects) include:

1. *What is your role in the project value chain?*

- *How could you do you enhance needed new skills or competence at the project level on energy-efficient and sustainable interventions?*
- *Do you feel you have enough methods to require skills and competence (like verifying skills during tendering or having a development phase in the procurement process)?*
- *What type of methods do you know or have used?*
- *Do you feel you need more training on the requirements methods for service providers about the skills and competence in energy-efficient and sustainable interventions?*

2. *Do you face any skill gaps in the delivery of energy-efficient and sustainable interventions?*
3. *Can you elaborate on these skill gaps and the ways in which these are addressed on projects?*
4. *Have you relied on training to address these skill gaps by upskilling your staff?*
5. *Are you satisfied with the training outcomes of your staff?*
6. *What are the learning outcomes acquired by your staff which helped address the above skill gaps? (What are the skills (use of tools) , Knowledge (know-how of the content and theory), or autonomy/responsibility (ability to act at task level and apply skills and competence)*
7. *- Has the process of reducing energy skill gaps increased the profitability of your organization?*
   -On the same note, has the process of reducing energy skill gaps and energy skills increased the added value of your organization?

<u>Stage 2: Consulting training providers</u>

The consultation took the form of interviews where training providers were asked to validate the Learning Outcomes identified to date and then discuss the potential of integrating further learning outcomes informed by Stage 1 consultation.

The detailed contributions of each partners, categorised by cluster and country can be found in Appendix 2.

Overall, inputs were received from the following partners: EnEffect, DTTN, RIL, LIST and Cardiff University. However, the inputs were not received in the form of new learning outcomes in the tables. Therefore, the results from the interviews and surveys/questionnaires received were then translated into LOs, following an interpretive approach, by the team of Cardiff University. This included:

interviews transcripts, survey results and statements, and, also, analysis reports. The process that was followed is the following:

a. Any statements that were considered relevant to a learner's experience or expected educational outcome were selected. They were then translated into Learning Outcomes by using the active verbs and keeping the original statements verbatim.
b. The statements were critically inserted in the tables by assessing a. the roles and b. the EQF Levels, in order to understand where it would be more appropriate to integrate them.

Below are the Learning Outcome Statements which were elicited from the partners' contributions:

1. Learning Outcomes Statements
2. Know how to fill in the related data of the model correctly
3. I know the principles of BIM
4. I can consult a BIM model and exchange information in a BIM project
5. Assist the client to set and specify information requirements and to compare between different structural solutions
6. Develop a strategy for multidisciplinary skills in the teams
7. Develop a strategy enlarge the scope of activity (following topics gravitate around energy & sustainability: acoustics, air quality, material quality, security,…
8. Learn how to integrate BIM model integration from beginning to operation
9. Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts
10. Design solutions for complex civil engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards
11. Develop courses on sustainable building
12. Learner knows about planning and management of buildings
13. Learner knows how to apply digital tools into the design phase, for courses on sustainability
14. Learner is able to apply BIM concepts in coordinating building energy performance optimization
15. Learner is able to promote the benefits of managing building life cycle information through digital tools
16. Students understand NZEB, circularity, and digitalization in construction
17. Learner is able to perform evaluations
18. Learner is familiar with most common tools and methods for quality checks such as energy performance surveys and corresponding energy certificates
19. Learner is involved with trainings
20. Learner knows the international standards for energy certification
21. Learner is able to develop a structured strategy and to formulate distinct goals
22. Learner understands more innovative concepts, like e.g: climate adaptation
23. Contractor knows how to execute energy efficiency
24. Develop and approve methodologies to approach certain issues, with regards to energy audits and energy performance certificates, for the national system
25. Develop official methodology to calculate the cooling demand
26. Develop methodology which is suited to new building norms

27. Develop standard values for the electrical equipment
28. Construction workers understands the correct installation for the product of the system
29. Know and use different calculation and modelling software
30. Find solutions to optimize the energy usage based for example on the electricity spot -prises and delivery from solar panels
31. Use of new materials / technics in renovation
32. Use of tools
33. Learner is able to enlarge the range of the available technical solutions to solve possible issues
34. Learner knows how to build components and how they must be used
35. Learner knows the physical properties of materials and their correct use to determine an envelope's stratigraphy. Learner has detailed knowledge of systems functioning and interconnections
36. Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase
37. Learner has technical physics knowledge, air-tightness principles, and materials knowledge along with BIM use to be able to interact organically with other professionals
38. Learner has theoretical and practical knowledge aiming to understand use and limits of technologies
39. Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention
40. Learner has the ability to use software and tools; knowledge on new construction methodologies
41. Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving
42. Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention
43. Learner has the ability to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and evaluating from time to time the appropriate solution
44. Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions
45. Learner can use specific software and training in the use of innovative tools
46. Learner has knowledge on design techniques/methodologies, innovative materials, technologies, and components, as well as of advanced management procedures in the construction projects
47. Learner has knowledge concerning regulations and legal aspects, combined with frequent changes of laws themselves by regulation authorities
48. Learner has the knowledge of communication and coordination among construction workers/professionals at different levels in the value chain.
49. Learner has the ability to promote a holistic approach, together with an ability to be multidisciplinary
50. Learner has strong practical skills to design and use software like MagiCAD.
51. Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings
52. Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.

53. Learner has an overall understanding of the holistic energy performance as systems, but also the dependencies in collaboration, management etc. for achieving the targeted energy efficiency.Dependences are many fold, for example to (1) other design disciplines (orientation, volume design (form factor), spatial design, structural and building design, quality levels of building materials, technical systems and equipment); to (2) procurement of technical systems and equipment; (3) to quality of construction work and assembly, especially airtightness
54. Learner has design know-how knowledge of the relation between actual use of energy and use level in calculations (based on industry level standards)
55. Learner has design know-how knowledge of the technical energy systems and their adjustment rules
56. Learner has design know-how knowledge on the count calculations in the end of building project should be required more often, meaning: repetition of IDA-ICE simulations, checking the usage groups and their behaviour profile, calibrating the system adjustment rules to real consumption rates
57. Learner has high level competence for energy simulation, in order to “estimate” absolute energy consumption rates
58. Learner has high quality facility management and efficient energy abilities. They have knowledge and skills for automated building service systems operations, ”running ” the building
59. Learner is competent in demanding energy design, estimation and optimation and has knowledge of primary energy sources and design competence of energy mix
60. Learner has excellent knowledge in BIM - based energy design and is capable of designs solution, calculation, simulations, optimation and standardisation of tools
61. Learner has excellent skills in use of energy design, simulation and optimation tools
62. Learner has competence on space usage change management during use of building and on the process
63. Learner is competent on change management of the targets of user groups or project partners, during design phase, as well as on the process
64. Learner is able to change management during the procurement and assembly of HVAC and energy systems and to process competence
65. Learner has target setting competence, competence on feasibility study to get realistic energy target values as well as competence of steering estimated energy efficiency target
66. Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration

As with the previous phase, the different contributions can be seen in the Appendixes, categorised by cluster and partners.

7.2 Phase Three: Third stage:

From the collection of all inputs by the partners, from Phase Two and Phase Three, the following final tables were created. To facilitate reading, where there is a “/” it means that different EQF level evaluations have been received by partners.

Table 7: European EE learning outcome matrix for Client & Client advisors i.e. Client &Project manager, manager, coordinator, briefing consultant.

No	Table 1: Country specific learning outcome and qualifications	EQF LEVEL			
Client & Client advisors Client & Project manager (C), Energy manager (EM), Energy coordinator (BC), briefing consultant (Bc)		C	EM	EC	Bc
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**4/6**	**5/7**	**5/6**	**5/-**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4/6	5/7	5/6	4/-
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	2/6	3/7	3/6	3/-
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance. 0	3/6	3/7	3/6	3/-
1.4	Learner is able to identify factors that can positively influence the economic and energy efficiency of a building.	4	4	4	4
1.5	Learner understands NZEB, circularity, and digitalization in construction	-	-	-	-
1.6	Know how to fill in the related data of the model correctly	-	-	-	-
1.7	know the principles of BIM	-	-	-	-
1.8	Learner understands more innovative concepts, like e.g: climate adaptation	-	-	-	-
1.9	Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase	-	-	-	-
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5/6**	**6/7**	**6**	**6/-**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	2/6	3/7	2/6	2/-
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	2/6	4/7	4/6	2/-

2.3	Explain relations between life-cycle costs, energy performance and building performance.	2	3	3	2
2.4	Learner knows the international standards for energy certification	-	-	-	-
2.5	Explain the energy state of art of buildings (organisational, economic, technical and behavioural variables) surveyed and mapped in terms of energy needs, use and cost	-	7	-	
2.6	Raise awareness actions on energy efficiency, understanding the needs of the territory and finding out technical and organizational synergies between its organization and the local needs	-	7	-	
2.8	Explain the importance of achieving adequate levels of ventilation, lighting, acoustic and thermal comfort	3	3	3	3
2.9	Understanding the importance of eliminating thermal bridges in buildings.	3	3	3	3
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**2**	**2/3**	**2/3**	**2**
3.1	Learner is able to use relevant energy target-setting tools.	2	2	2	2
3.2	Can consult a BIM model and exchange information in a BIM project.	-	-	-	-
3.3	Learner is able to use relevant energy target-setting tools.	-	7	6	
3.4	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	2	3	3	2
3.5	Learner is able to set an energy efficiency intervention defined in its essential components in accordance with the needs and resources available.	-	7	6	
3.6	Ability to explain and use the key economic parameters: payback period, net present value, etc.	4	4	4	4
3.7	Lerner is able to set energy efficiency improvement intervention, implemented, organised and monitored in accordance with the required standards.	-	7	-	-
3.8	Learner is able to prefigure possible intervention scenarios by assessing their feasibility and technical/economic viability	-	-	6	-
3.9	Learner can use specific software and training in the use of innovative tools	-	-	-	-

LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**2**	**3**	**3/2**	**2**
4.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	2	3	3	2
4.2	Learner is able to use relevant energy target-setting tools.	2	2	2	2
4.3	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	6	7	-	
4.4	Adopt ways for raising awareness about environmental issues related to climate change and sustainable development, promoting interventions with natural materials and low environmental impact	6	-	-	
4.5	Transfer knowledge about the technical-economic/commercial-environmental advantages of a project featured by technical solutions aimed at energy-environmental quality	6	-	-	
4.6	Learner is able to interpret correctly the legal framework for energy efficiency in buildings and also nZEBs.	4	4	4	3
4.7	Learner has theoretical and practical knowledge aiming to understand use and limits of technologies	-	-	-	-
4.8	Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving	-	-	-	-
4.9	Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions	-	-	-	-
4.10	Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.	-	-	-	-
4.11	Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.	-	-	-	-
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**	**2**	**3**	**3**	**2**
5.1	Learner is able to explain and use energy production/consumption methods.	3/-	4/7	4/-	3/-
5.2	Develop a strategy for multidisciplinary skills in the team	-	-	-	-

5.3	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4	-
5.4	Learner is able to explain the difference between investment cost and energy saving cost.	4	4	4	3
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**	**2**	**2**
6.1	Learner is able to use tools such as energy management software.	2/-	2/7	2/6	2/-
6.2	Learner is able to promote the benefits of managing building life cycle information through digital tools	-	-	-	-
6.2	Learner is able to adopt techniques and tools for the mantainance and management of technical systems, by identifying the best mix of resources, instruments, time and methodologies and to define a plan for the energy performance improvement	-	-	6	
6.2	Learner is able to identify the specialties involved in the energy management procedures and provide quality assurance methods for these procedures.	5	4	4	3
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	-	-	-	-
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	-	-	-	-
6.6	Learner is able to coordinate & manage the consistency of the BIM model	-	-	-	-
6.7	Learner has high level competence for energy simulation, in order to “estimate” absolute energy consumption rates.	-	-	-	-
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	-	-	-	-
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	-	-	-	-

7.2	Validate and check compatibility of the domain model and manage and repair conflict.	-	-	-	-
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	-	-	-	-
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	-	-	-	-
7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	-	-	-	-
7.6	Instruct and audit contractors on construction site on critical points.	-	-	-	-
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	-	-	-	-
7.8	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts.	-	-	-	-
7.9	Learner has the ability to use software and tools; knowledge on new construction methodologies	-	-	-	-
LO8	Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)	**-**	**-**	**-**	**-**
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	-	-	-	-
8.2	Use relevant energy design calculations and assessment tools in different design phases.	-	-	-	-
8.3	Use different tools for BIM-based collaborative working.	-	-	-	-
8.4	Create combination model and use model checking tools for clash detection.	-	-	-	-

8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	-	-	-	-
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	-	-	-	-
8.7	Prepare the domain model for simulation and assessments	-	-	-	-
8.8	Use tools for environmental impact analyses.	-	-	-	-
8.9	Use project data and file management systems.	-	-	-	-
8.10	Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention	-	-	-	-
8.11	Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention	-	-	-	-
8.12	Learner has target setting competence, competence on feasibility study to get realistic energy target values as well as competence of steering estimated energy efficiency target	-	-	-	-
8.13	Learner is competent on change management of the targets of user groups or project partners, during design phase, as well as on the process.	-	-	-	-
8.14	Learner is able to change management during the procurement and assemply of HVAC and energy systems and to process competence.	-	-	-	-
8.15	Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration	-	-	-	-

Table 7 European EE learning outcome matrix for Client & Client advisors i.e. Client & Project manager, manager, coordinator, briefing consultant.

Table 8: European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH),Assistant designer (ASS)

No	Table 2: Country specific learning outcome and qualifications	EQF LEVEL		
Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)		CD	ARCH	ASS

LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6/-**	**6/8**	**6/-**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	6/-	6/8	5/-
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	6/-	6/8	5/-
1.3	Summarize the ideas of digital space and asset management.	6	6	6
1.4	Explain the European and national concepts of sustainable energy building rating and certification systems.	4	4	3
1.5	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	6	6	5
1.6	Know how to fill in the related data of the model correctly	-	-	-
1.7	know the principles of BIM	-	-	-
1.8	Learner understands NZEB, circularity, and digitalization in construction	-	-	-
1.9	Learner understands more innovative concepts, like e.g: climate adaptation	-	-	-
1.10	Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase			
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**5**	**5**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	6/-	5/8	5/-
2.2	Distinguish the level of passive performance	6/-	6/8	6/-
2.3	Understand and know the 4 performance criteria	6/-	6/-	6/-
2.4	Learner knows the international standards for energy certification	-	-	-
2.5	Summarise and illustrate the potentials of renewable energy sources including district-scale systems.	4	4	3

LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5/-**	**5/8**	**4/-**
3.1	Learner is able to understand and describe how to capitalize on passive energy gains.	5/-	5/8	4/-
3.2	Can consult a BIM model and exchange information in a BIM project.	-	-	-
3.3	Learner knows how to apply digital tools into the design phase, for courses on sustainability	-	-	-
3.4	Learner is able to apply BIM concepts in coordinating building energy performance optimization	-	-	-
3.2	Manage techniques for improving the building performance in terms of environmental comfort adopting advanced engineering systems (active, passive, mixed, hybrid systems	-	8	-
3.2	Ability to explain and use the key economic parameters: payback period, net present value, etc.	4	4	3
3.3	Learner can use specific software and training in the use of innovative tools	-	-	-
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**4/-**	**4/8**	**3/-**
4.1	Learner is able to use relevant energy target-setting tools.	4/-	4/8	3/-
4.2	Understanding and ability to explain the role and importance of integrating different RES installations.	4	4	3
4.3	Learner knows how to build components and how they must be used	-	-	-
4.4	Learner has theoretical and practical knowledge aiming to understand use and limits of technologies	-	-	-
4.5	Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving	-	-	-
4.6	Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions	-	-	-
4.7	Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.	-	-	-

4.8	Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.	-	-	-
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**6**	**6**	**5**
5.1	Learner is able to explain and use energy production/consumption methods.	6/-	5/8	5/-
5.2	Ability to perform energy analyses including dynamic simulations.	6	6	5
5.3	Develop a strategy for multidisciplinary skills in the team	-	-	-
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	-	-	-
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**6**	**6**	**6**
6.1	Identify the services, methodologies (BIM) and people to constitute an operational team	6	6	6
6.2	Learner is able to promote the benefits of managing building life cycle information through digital tools	-	-	-
6.3	Ability to work collaboratively with all project stakeholders: design team, clients, users, manufacturers, workers and building authorities.	6	6	6
6.4	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities	-	-	-
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design	-	-	-
6.6	Learner has high level competence for energy simulation, in order to “estimate” absolute energy consumption rates.	-	-	-
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**6/-**	**6/8**	**6/-**

7.1	Master the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.	6	6	6
7.2	Learner is able to design and create models based on BIM software from an architectural point of view and to make energy analysis	-	8	-
7.3	Validate and check compatibility of the energy model and also manage and eliminate conflicts.	6	6	6
7.4	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	-	-	-
7.5	Validate and check compatibility of the domain model and manage and repair conflict.	-	-	-
7.6	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	-	-	-
7.7	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	-	-	-
7.8	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	-	-	-
7.9	Instruct and audit contractors on construction site on critical points.	-	-	-
7.10	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	-	-	-
7.11	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts	-	-	-
7.12	Learner has the ability to use software and tools; knowledge on new construction methodologies	-	-	-
LO8	Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)	**-**	**-**	**-**
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	-	-	-

8.2	Use relevant energy design calculations and assessment tools in different design phases.	-	-	-
8.3	Use different tools for BIM-based collaborative working.	-	-	-
8.4	Create combination model and use model checking tools for clash detection.	-	-	-
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	-	-	-
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	-	-	-
8.7	Prepare the domain model for simulation and assessments	-	-	-
8.8	Use tools for environmental impact analyses.	-	-	-
8.9	Use project data and file management systems.	-	-	-
8.10	Understand how to drastically reduce the losses of buildings	6	5	5
8.11	Presenting technical solutions for eliminating thermal bridges in buildings.	6	6	5
8.12	Learner is able to enlarge the range of the available technical solutions to solve possible issues	-	-	-
8.13	Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention	-	-	-
8.14	Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention	-	-	-
8.15	Learner has the ability to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and evaluating from time to time the appropriate solution	-	-	-
8.16	Learner is competent in demanding energy design, estimation and optimation and has knowledge of primary energy sources and design competence of energy mix	-	-	-

8.17	Learner has excellent knowledge in BIM - based energy design and is capable of designs solution, calculation, simulations, optimation and standardisation of tools	-	-	-
8.18	Learner has excellent skills in use of energy design, simulation and optimation tools	-	-	-
8.19	Learner has excellent skills in use of energy design, simulation and optimation tools	-	-	-
8.20	Learner is competent on change management of the targets of user groups or project partners, during design phase, as well as on the process.	-	-	-
8.21	Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration	-	-	-

Table 8 European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)

Table 9. European wide EE learning outcome matrix for structural design roles i.e.Structural design and coordinator (structural), Assistant designer

No	**Table 3:** Country specific learning outcome and qualifications	EQF Level				
Structural design roles Structural engineering design Magister (SED), Construction Management (Bachelor), Project Management in Construction (Master)		SED	CM	PMC	SD	ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	-	-	-	**-/7**	**-/7**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	4	5	-	-

1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	3	4	5	-	-
1.3	Summarize the ideas of digital space and asset management.	2	2	2	-	-
1.4	Explain the added value of using energy model open file formats to ensure interoperability.	2	2	2	-	-
1.5	Explain the main contents and apply relevant parts of national energy guidelines.	3	3	4	-	-
1.6	Learner is able to understand the interest of integrating renewable energies into BIM (Building Information Modeling) models.	-	-	-	7	6
1.7	Know how to fill in the related data of the model correctly	-	-	-	-	-
1.8	know the principles of BIM	-	-	-	-	-
1.9	Learner understands NZEB, circularity, and digitalization in construction	-	-	-	-	-
1.10	Learner understands more innovative concepts, like e.g: climate adaptation	-	-	-	-	-
1.11	Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase	-	-	-	-	-
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**-**	**-**	**-**	**-/7**	**-/6**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	4	5	6	-	-
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	4	5	6	-	-
2.3	Explain relations between life-cycle costs, energy performance and	5	5	6	-	-

	building performance.					
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	4	4	5	-	-
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	3	3	4	-	-
2.6	Explain the potentials of different energy-compatible assessment,simulation and optimization tools in achieving good energy and building performance.	3	4	5	-	-
2.7	Learner is able to understand the impact of RE in BIM models.	-	-	-	6	6
2.8	List and explain indoor comfort criteria	3	4	5	-	-
2.9	Learner knows the international standards for energy certification	-	-	-	-	-
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	-	-	-	**-/6**	**-/6**
3.1	Explain the overall design process for energy-efficient building.	3	4	5	-	-
3.2	Assist client to set realistic and achievable energy and building performance target.	3	4	5	-	-
3.3	Perform preliminary energy analysis in the early project stages for both new and renovation projects to add value for the decision making.	4	4	5	-	-
3.4	Assist the client to set and specify information requirements.	4	4	5	-	-

3.5	Explain how to support owner's effective decision-making and opinion formation of other stakeholders.	4	4	5	-	-
3.6	Illustrate how to direct the design towards set targets utilizing the capacityof different kinds of assessment methods relevant for building construction design.	5	5	6	-	-
3.7	Explain the flow of design teamwork and demonstrate how to prepare, compare and improve alternative concepts.	5	5	6	-	-
3.8	Lead / assist the tasks related to technical documents for the building authorities.	6	5	6	-	-
3.9	Learner will be able to be a player in the evolution of BIM models towards BIM-GEM models (Management, Operation, Maintenance).	-	-	-	6	6
3.10	Describe different solutions for improving the energy efficiency in buildings	4	4	5	-	-
3.11	Assist the client to set and specify information requirements. Assist the client to set and specify information requirements and to compare between different structural solutions	4	4	5	-	-
3.12	Learner is able to apply BIM concepts in coordinating building energy performance optimization	-	-	-	-	-
3.13	Can consult a BIM model and exchange information in a BIM project.	-	-	-	-	-
3.14	Learner can use specific software and training in the use of innovative tools	-	-	-	-	-
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**-**	**-**	**-**	**-/6**	**-/6**
4.1	Integration into public contracts for new buildings and renovation	-	-	-	6	6

4.2	Apply the set performance targets related to building design into BIM-based design process.	4	4	4	-	-
4.4	Iterate the design solutions to meet the set targets of building performance and energy efficiency.	4	4	4	-	-
4.4	Consider options of renewable energy and optimize its potentials.	3	3	4	-	-
4.5	Design solutions upgradable to meet coming EE systems requirements (options for future EE improvements)	3	3	3	-	-
4.6	Create different energy efficient design concepts renewable energy systems.	3	4	4	-	-
4.7	Perform energy analyses including dynamic simulations.	2	2	2	-	-
4.8	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2	2	2	-	-
4.9	Perform lightning calculations, analyses and simulations.	2	2	2	-	-
4.10	Discuss and assess the effect of main building materials and main producttype selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4	5	5	-	-
4.11	Use life cycle cost calculation including life-cycle studies changing influential design parameters.	5	4	5	-	-
4.12	Share the results of energy simulations, discuss the options and update domain BIMs.	4	3	4	-	-
4.5	Perform energy analyses including dynamic simulations.	2	2	2	-	-
4.6	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2	2	2	-	-

4.7	Perform lightning calculations, analyses and simulations.	2	2	2	-	-
4.8	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4	5	5	-	-
4.9	Learner knows how to build components and how they must be used	-	-	-	-	-
4.10	Learner has theoretical and practical knowledge aiming to understand use and limits of technologies	-	-	-	-	-
4.11	Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving	-	-	-	-	-
4.12	Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions	-	-	-	-	-
4.13	Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.	-	-	-	-	-
4.14	Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.	-	-	-	-	-
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**-**	**-**	**-**	**-**	**-**
5.1	Prepare the Construction engineer's domain model on the basis of set targets and definitions given in architect's domain model.	6	3	4		-
5.2	Create and update digital (BIM-linked) building specification with materialand dimensional information to reflect owner's quality and performance requirements.	4	3	4	-	-
5.3	Explain essential issues of the needs of initial information and the potentials of different inventory surveys in refurbishment projects.	5	4	5	-	-

5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4	-	-
5.5	Prepare/assist information needed for specific use cases such as bill of quantities.	6	5	6	-	-
5.6	Prepare/assist the domain model for simulation and assessment.	5	4	5	-	-
5.7	Prepare/assist models and information for planning authority and in required data format.	4	3	4	-	-
5.8	Prepare/assist models and information for procurement and construction.	5	4	5	-	-
5.9	Prepare models to fulfil quality and information requirements for quality control and assurance processes in construction.	5	4	5	-	-
5.10	Prepare models based on data and information requirements of sustainable care and maintenance processes.	4	4	5	-	-
5.11	Prepare information for As-Built Models and Maintenance model for utilization of client and building management.	4	4	5	-	-
5.12	Prepare/assist in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performancerequirements.	5	4	5	-	-
5.13	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4	-	-
5.14	Develop a strategy for multidisciplinary skills in the teams	-	-	-	-	-
5.16	Learner knows the physical properties of materials and their correct use to determine an envelope's stratigraphy. Learner has detailed knowledge of systems functioning and interconnections.	-	-	-	-	-
5.17	Learner has technical physics knowledge, air-tightness principles, and materials knowledge along with BIM use to be able to interact organically with other professionals.	-	-	-	-	-

LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve settargets.**	-	-	-	-	-
6.1	Describe the essential parts of the procedure for BIM based collaboration.	4	4	5	-	-
6.2	Describe different collaborative interdisciplinary and open BIM working methods, tools and processes.	4	4	5	-	-
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	4	4	5	-	-
6.4	Prepare relevant visualization models to enable information sharing, decision making and opinion formation.	5	4	5	-	-
6.5	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	-	-	-	-	-
6.6	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	-	-	-	-	-
6.7	Learner is able to promote the benefits of managing building life cycle information through digital tools	-	-	-	-	-
6.8	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	6	5	6	-	-
6.9	Collaborate with the help of communication platforms and processes.	6	5	6	-	-
6.10	Clarify and delegate specific responsibilities in the execution of works	4	4	5	-	-
6.11	Learner is able to promote the benefits of managing building life cycle information through digital tools	-	-	-	-	-
6.12	Learner has high level competence for energy simulation, in order to “estimate” absolute energy consumption rates.	-	-	-	-	-

LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	-	-	-	-	-
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	4	3	4	-	-
7.2	Describe and assess the quality assurance procedures according to the stages of assembly of building elements and systems.	4/-	3/4	5/-	-	-
7.3	Validate and check compatibility of the domain model and manage and repair conflict.	4	3	4	-	-
7.4	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	5	4	5	-	-
7.5	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	5	4	5	-	-
7.6	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	4	3	4	-	-
7.7	Instruct and audit contractors on construction site on critical points.	6	4	5	-	-
7.8	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts	-	-	-	-	-
7.9	Learner has the ability to use software and tools; knowledge on new construction methodologies	-	-	-	-	-
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	-	-	-	-	-
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	6	4	4	-	-

8.2	Use relevant energy design calculations and assessment tools in different design phases.	2	3	3	-	-
8.3	Use different tools for BIM-based collaborative working.	5	4	5	-	-
8.4	Create combination model and use model checking tools for clash detection.	4	3	4	-	-
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	3	3	4	-	-
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	5	3	4	-	-
8.7	Prepare the domain model for simulation and assessments	4	3	4	-	-
8.8	Use tools for environmental impact analyses.	3	3	4	-	-
8.9	Use tools for environmental impact analyses.	5	4	5	-	-
8.10	Develop a strategy enlarge the scope of activity (following topics gravitate around energy & sustainability: acoustics, air quality, material quality, security,…	-	-	-	-	-
8.11	Design solutions for complex civil engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards	-	-	-	-	-
8.12	Learner is familiar with most common tools and methods for quality checks such as energy performance surveys and corresponding energy certificates	-	-	-	-	-

8.13	Develop and approve methodologies to approach certain issues, with regards to energy audits and energy performance certificates, for the national system	-	-	-	-	-
8.14	Learner is able to enlarge the range of the available technical solutions to solve possible issues	-	-	-	-	-
8.15	Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention	-	-	-	-	-
8.16	Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention	-	-	-	-	-
8.17	Learner has the ability to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and evaluating from time to time the appropriate solution	-	-	-	-	-
8.18	Learner is competent in demanding energy design, estimation and optimation and has knowledge of primary energy sources and design competence of energy mix	-	-	-	-	-
8.19	Learner has excellent knowledge in BIM - based energy design and is capable of designs solution, calculation, simulations, optimation and standardisation of tools	-	-	-	-	-
8.20	Learner is competent on change management of the targets of user groups or project partners, during design phase, as well as on the process.	-	-	-	-	-
8.21	Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration	-	-	-	-	-

Table 9 European wide EE learning outcome matrix for structural design roles i.e. Structural design and coordinator (structural), Assistant designer

Table 10. European EE learning outcome matrix for building service design roles i.e. HVACand energy design and coordinator (HVAC), assistant designer

No	**Table 4:** Country specific learning outcome and qualifications	EQF Level	
Building services design roles HVAC and energy design (HVAC+E) and Energy coordinator (HVAC), assistant designer (ASS)		HVAC +E	ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6/7**	**5/-**
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7/-	7/-
1.2	Know the health and economic issues related to good IAQ.	7	7
1.3	Know the principles of safety, reliability, energy efficiency and environmental impact underlying the management of the systems	7	-
1.4	Knowledge of different situations when ventilation airflow can be limited/increased	6	6
1.5	Knowledge of the factors that influence a ventilation system	6	6
1.6	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	7
1.7	Know the health and economic issues related to good IAQ.	7	7
1.8	Learner understands NZEB, circularity, and digitalization in construction	-	-
1.9	Learner understands more innovative concepts, like e.g: climate adaptation	-	-
1.10	Know how to fill in the related data of the model correctly	-	-
1.11	know the principles of BIM	-	-
1.12	Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase	-	-
L02	**Learner is able to explain the fundamentals of energy sustainability and**	**6**	**6**

	energy-efficient buildings and building performance.		
2.1	Know the regulations regarding IAQ and ventilation in buildings.	6/7	6/-
2.2	Know the rules for the design, sizing and implementation of a residential ventilation system.	6	6
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	6/7	6/-
2.4	Know the rules for the design, sizing and implementation of a residential, tertiary or industrial ventilation system.	7	-
2.5	Learner knows the international standards for energy certification.	-	-
2.6	Learner has design know-how knowledge of the relation between actual use of energy and use level in calculation.	-	-
2.7	Learner has design know-how knowledge of the technical energy systems and their adjustment rules.	-	-
2.8	Learner has design know-how knowledge on the count calculations in the end of building project should be required more often, meaning: repetition of IDA-ICE simulations, checking the usage groups and their behaviour profile, calibrating the system adjustment rules to real consumption rates	-	-
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**4/5/7**	**3/5/-**
3.1	Know the keys to a successful ventilation and IAQ audit.	5/7	5/-
3.2	Knowledge of all factors influencing the thermal comfort in buildings.	6	6
3.3	Can consult a BIM model and exchange information in a BIM project.	-	-
3.4	Learner can use specific software and training in the use of innovative tools	-	-
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**3/4**	**3/4**
4.1	Know the principles of measurement, methods of analysis, measurement protocols and sampling methods.	-/4/3/4	**-/4/3/3**
4.2	Knowledge of active and passive methods for utilization of renewable energy sources.	5	5
4.3	Perform energy analyses including dynamic simulations.	-	-

4.4	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	-	-
4.5	Perform lightning calculations, analyses and simulations.	-	-
4.6	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	-	-
4.7	Perform energy analyses including dynamic simulations.	-	-
4.8	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	-	-
4.9	Perform lightning calculations, analyses and simulations.	-	-
4.10	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	-	-
4.11	Learner knows how to build components and how they must be used	-	-
4.12	Learner has theoretical and practical knowledge aiming to understand use and limits of technologies	-	-
4.13	Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving	-	-
4.14	Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions	-	-
4.15	Learner has strong practical skills to design and use software like MagiCAD.	-	-
4.16	Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.	-	-
4.17	Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.	-	-
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**3/5**	**2/4**
5.1	Find avenues for improving IAQ.	5/-	4/3

5.2	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	-	-
5.3	Learner has technical physics knowledge, air-tightness principles, and materials knowledge along with BIM use to be able to interact organically with other professionals	-	-
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2/4**	**2/4**
6.1	Know the methods of managing indoor air quality and the methods for calculating thermal loads	7	
6.2	Provide documentation on the project by means of calculation reports and graphics (plans, sections, functional diagrams, etc.).	7	
6.3	Know the methods of managing indoor air quality	5	5
6.4	Learner is able to use different approaches and features in creating models of energy consumption of buildings for the heating and cooling periods.	7	6
6.5	Learner is able to find solutions to optimize the energy usage based for example on the electricity spot -prises and delivery from solar panels.	-	-
6.6	Learner is able to promote the benefits of managing building life cycle information through digital tools	-	-
6.7	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	-	-
6.8	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	-	-
6.9	Learner has an overall understanding of the holistic energy performance as systems, but also the dependencies in collaboration, management etc. for achieving the targeted energy efficiency.Dependences are many fold, for example to (1) other design disciplines (orientation, volume design (form factor), spatial design, structural and building design, quality levels of building materials, technical systems and equipment); to (2) procurement of technical systems and equipment; (3) to quality of construction work and assembly, especially airtightness.	-	-

6.10	Learner has high level competence for energy simulation, in order to "estimate" absolute energy consumption rates.	-	-
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**-**	**-**
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	-	-
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	-	-
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	-	-
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	-	-
7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	-	-
7.6	Instruct and audit contractors on construction site on critical points.	-	-
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	-	-
7.8	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts	-	-
7.9	Learner has the ability to use software and tools; knowledge on new construction methodologies	-	-
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	**-**	**-**
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	-	-

8.2	Use relevant energy design calculations and assessment tools in different design phases.	-	-
8.3	Use different tools for BIM-based collaborative working.	-	-
8.4	Create combination model and use model checking tools for clash detection.	-	-
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	-	-
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	-	-
8.7	Prepare the domain model for simulation and assessments	-	-
8.8	Use tools for environmental impact analyses.	-	-
8.9	Use project data and file management systems.	-	-
8.10	Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention	-	-
8.11	Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention	-	-
8.12	Learner has the ability to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and evaluating from time to time the appropriate solution	-	-
8.13	Learner has excellent knowledge in BIM - based energy design and is capable of designs solution, calculation, simulations, optimation and standardisation of tools	-	-
8.14	Learner has excellent skills in use of energy design, simulation and optimation tools	-	-

8.15	Learner is competent on change management of the targets of user groups or project partners, during design phase, as well as on the process.	-	-
8.16	Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration	-	-

Table 10 European EE learning outcome matrix for building service design roles i.e. HVAC and energy design and coordinator (HVAC), assistant designer

Table 11. European wide EE learning outcome matrix for Construction work roles i.e. Sitemanager, Construction site workers and installers

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
	Construction work roles Site manager (SM), Construction site workers and installers (CW)	SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6/-**	**5/3**
1.1	Acquire the basics of efficient rehabilitation.	6/-	6/3
1.2	Know the keys to renovating an existing building at low consumption level.	6/5	5/5
1.3	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	5	4
1.4	Explain added value of sustainable energy efficient practices and sustainable projects.	4	4
1.5	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3
1.7	Ability to read working drawings, assembly plans and specifications.	5	4

1.8	Understanding the principles for achieving high thermal performance envelopes	4	3
1.9	Knowledge of the basic requirements for safety, occupational health and fire protection	2	2
1.10	Know how to fill in the related data of the model correctly	-	-
1.11	know the principles of BIM	-	-
1.12	Construction workers understands the correct installation for the product of the system	-	-
1.13	Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase	-	-
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**3/5**	**2/4**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	4
2.3	Understand the benefits of effective rehabilitation and its opportunities for professionals.	5	5
2.4	Understanding and application of new working methods, regulations and outlooks on effective rehabilitation.	4	4
2.5	Knowledge of the standards for thermal comfort	4	4
2.5	Learner knows the international standards for energy certification	-	-
LO3	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**4**
3.1	Explain the importance efficient rehabilitation and low consumption level.	**5**	**5**
3.2	Learner is able to identify the critical features of buildings with low consumption	4	4
3.3	Can consult a BIM model and exchange information in a BIM project.	-	-
3.4	Learner can use specific software and training in the use of innovative tools	-	-
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**

4.1	Know the principles of measurement, methods of analysis of heat low from buildings. (LO6?)	**5**	**5**
4.2	Know the principles of organization of spaces, ventilation, air tightness and humidity management. (LO6?)	**5**	**5**
4.3	Learner knows how to build components and how they must be used	-	-
4.4	Learner has theoretical and practical knowledge aiming to understand use and limits of technologies	-	-
4.5	Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving	-	-
4.6	Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions	-	-
4.7	Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.	-	-
4.8	Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.	-	-
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**	**5**	**5**
5.1	Know the principles of wall insulation, thermal bridges and thermal comfort.	**5**	**5**
5.2	Contractor knows how to execute energy efficiency	-	-
5.2	Develop a strategy for multidisciplinary skills in the team	-	-
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	-	-
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**4**	**4**
6.1	Know the principles of heating and domestic hot water and lighting and electrical equipment specifically in old houses.	**4**	**4**
6.2	Testing thermo-hydraulic systems in accordance with efficiency and safety standards		**3**

6.2	Ability to evaluate the performance of an envelope element, knowledge of the typical values and the effects they have on the thermal comfort, thermal bridges	**5**	**5**
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	4	4
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	6	5
6.6	Learner has high level competence for energy simulation, in order to "estimate" absolute energy consumption rates.	-	-
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**-**	**-**
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	-	-
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	-	-
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	-	-
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	-	-
7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	-	-
7.6	Instruct and audit contractors on construction site on critical points.	-	-
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	-	-
7.8	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts	-	-
7.9	Learner has the ability to use software and tools; knowledge on new construction methodologies	-	-

LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	-	-
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	-	-
8.2	Use relevant energy design calculations and assessment tools in different design phases.	-	-
8.3	Use different tools for BIM-based collaborative working.	-	-
8.4	Create combination model and use model checking tools for clash detection.	-	-
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	-	-
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	-	-
8.7	Prepare the domain model for simulation and assessments	-	-
8.8	Use tools for environmental impact analyses.	-	-
8.9	Use project data and file management systems.	-	-
8.10	Learner is able to enlarge the range of the available technical solutions to solve possible issues	-	-
8.11	Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention	-	-
8.12	Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention	-	-
8.13	Learner has the ability to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and evaluating from time to time the appropriate solution	-	-
8.14	Learner is able to change management during the procurement and assemply of HVAC and energy systems and to process competence.	-	-
8.15	Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration	-	-

Table 11 European wide EE learning outcome matrix for Construction work roles i.e. Site manager, Construction site workers and installers

Table 12. European EE learning outcome matrix for Maintenance work roles i.e.Maintenance operator, Property manager, Care taker

No	Table 6: Country specific learning outcome and qualifications	EQF Level		
Maintenance work roles Maintenance operator (MO), Property manager (PM), Care taker (CT)		MO	PM	CT
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6/-**	**6/4**	**6/-**
1.1	Knowing how to identify the needs and challenges of the co-ownership in terms of renovation.	6	6	5
1.2	Acquire the basics of renovation and energy performance.	6/-	6/4	5/-
1.3	Know the different stages of a renovation project.	6/-	5/4	5/-
1.4	Learner understands NZEB, circularity, and digitalization in construction	-	-	-
1.4	Know how to fill in the related data of the model correctly	-	-	-
1.5	know the principles of BIM	-	-	-
1.6	Learner knows general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase	-	-	-
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6/-**	**6/4**	**6/-**
2.1	To be able to collect the data necessary for the good start of the project and to know how to use an audit.	-	4	-
2.2	Evaluate the potential of the co-ownership and be able to unite around the issue of renovation.	5	4	4
2.3	To be able to collect the data necessary for the good start of the project	5	5	4
2.4	To know how to use an audit.	-	-	-
2.5	To be able to collect the data necessary for the good start of the project and to know how to use an audit.	**5**	**5**	**4**

2.6	Understand the different roles of each: Syndic, union council, AMO, …	6/-	6/4	5/-
2.7	Know how to order a quality project management.	6/-	6/4	5/-
2.8	Basic knowledge on conflict management	-	4	-
2.9	Learner knows the international standards for energy certification	-	-	-
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**5**
3.1	Know the different types of financing and be able to express yourself on this subject.	5/-	5/4	4/-
3.2	Be able to collect different documentation aiming at requiring financing and incentives	-	4	-
3.3	Can consult a BIM model and exchange information in a BIM project.	-	-	-
3.4	Learner is able to use of new materials / technics in renovation.	-	-	-
3.5	Knowledge on how to interpret the energy audit and energy certificate of a building.	5	4	3
3.6	Learner can use specific software and training in the use of innovative tools	-	-	-
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**5/-**	**5/4**	**5/-**
4.1	Know how to mobilize before the general assembly.	5/-	5/4	5/-
4.2	Know the procedure to follow for a calm and legally unchallengeable vote on the work.	5	5	4
4.3	To be able to follow the work: understand the role of each person and ensure the proper conduct of the site.	5/-	5/4	4/-
4.4	Inform and raise awareness among the tenants and the owners on the range of technical, economic and managing opportunities for an energy efficient renovation of the concerned building	-	4	-
4.5	Learner is able to identify opportunities for energy savings.	5	4	3
4.6	Learner is able to promote the benefits of managing building life cycle information through digital tools	-	-	-
4.7	Learner is familiar with most common tools and methods for quality checks such as energy performance surveys and corresponding energy certificates	-	-	-

4.8	Learner knows how to build components and how they must be used	-	-	-
4.9	Learner has theoretical and practical knowledge aiming to understand use and limits of technologies	-	-	-
4.10	Learner has technical and theoretical knowledge; the ability to act at the task level and to perform problem-solving	-	-	-
4.11	Learner can make conscious use of computational software; has understanding of physical phenomena and conscious adoption of technically feasible solutions	-	-	-
4.12	Learner has knowledge of RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.	-	-	-
4.13	Learner is aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc.	-	-	-
5.1	Develop a strategy for multidisciplinary skills in the team	-	-	-
5.2	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	-	-	-
6.1	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	-	-	-
6.2	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	-	-	-
6.3	Learner has high level competence for energy simulation, in order to "estimate" absolute energy consumption rates.	-	-	-
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**-**	**-**	**-**
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	-	-	-
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	-	-	-

7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	-	-	-
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	-	-	-
7.5	Comment product and system providers' designs and comment thecontractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	-	-	-
7.6	Instruct and audit contractors on construction site on critical points.	-	-	-
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	-	-	-
7.8	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts	-	-	-
7.9	Learner has the ability to use software and tools; knowledge on new construction methodologies	-	-	-
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	**-**	**-**	**-**
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	-	-	-
8.2	Use relevant energy design calculations and assessment tools in different design phases.	-	-	-
8.3	Use different tools for BIM-based collaborative working.	-	-	-
8.4	Create combination model and use model checking tools for clash detection.	-	-	-
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	-	-	-
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	-	-	-
8.7	Prepare the domain model for simulation and assessments	-	-	-
8.8	Use tools for environmental impact analyses.	-	-	-

8.9	Use project data and file management systems.	-	-	-
8.10	Learner is able to enlarge the range of the available technical solutions to solve possible issues	-	-	-
8.11	Learner has the ability to use different software; contract management methodologies; specific regulations such has security and fire prevention.	-	-	-
8.15	Learner has improved knowledge and increased ability to interact with others in the design-management process of the building intervention.	-	-	-
8.16	Learner has high quality facility management and efficient energy abilities. They have knowledge and skills for automated building service systems operations, ”running ” the building.	-	-	-
8.17	Learner has competence on space usage change management during use of building and on the process.	-	-	-
8.18	Learner has target setting competence, competence on feasibility study to get realistic energy target values as well as competence of steering estimated energy efficiency target	-	-	-
8.19	Learner is capable of collaboration, co-working and co-creation in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration	-	-	-

Table 12 European EE learning outcome matrix for Maintenance work roles i.e. Maintenance operator, Property manager, Care taker

Chapter 8. Profile Tables: Tables of Roles & Learning Outcomes, categorised by: knowledge, skills, autonomy & responsibility

Following the definitions for knowledge, skills, and autonomy and responsibility as presented in Chapter 2, this section aims to present a tentative interpretation of potential professional profiles, as informed by the Learning Outcomes Matrices, with all the integrated inputs from the INSTRUCT partners. The inputs include the contributions from both phases two and three. The process that was followed was interpretive, in order to qualitatively align the learning outcomes with the concepts of knowledge, skills, and autonomy and responsibility. The relevant active verbs and/or concepts aligned with the are highlighted in bold letters, to facilitate the reading of the tables.

	Clients & Client Advisors
Knowledge	
	• ***Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• ***Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.***
	• ***Recall*** *essential contents,* ***summarize*** *and* ***give examples*** *of energy interventions terminologies, definitions and standards.*
	• ***Explain*** *added value of sustainable energy efficient practices and sustainable projects.*
	• ***Explain*** *the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.*
	• ***Explain*** *and* ***give examples*** *of aspects and terminology related to energy interventions and building energy performance.*
	• ***Describe*** *the aspects (financial and environmental) and energy related indicators and building performance.*
	• ***Explain*** *relations between life-cycle costs, energy performance and building performance.*
	• ***Explain*** *the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.*
	• ***Understanding*** *the importance of eliminating thermal bridges in buildings.*
	• ***Explain*** *the importance of achieving adequate levels of ventilation, lighting, acoustic and thermal comfort.*
	• ***Explain*** *the energy state of art of buildings (organisational, economic, technical and behavioural variables) surveyed and mapped in terms of energy needs, use and cost.*
	• *Learner is able to* ***explain*** *the difference between investment cost and energy saving cost.*
	• *Learner is able to* ***explain*** *the difference between investment cost and energy saving cost.*
	• *Learner* ***understands*** *NZEB, circularity, and digitalization in construction*
	• ***Know*** *how to fill in the related data of the model correctly*
	• ***Know*** *the principles of BIM*
	• *Learner* ***understands*** *more innovative concepts, like e.g: climate adaptation*
	• *Learner* ***knows*** *the international standards for energy certification*
	• *Learner* ***knows*** *general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase*

Skills	
	• ***Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.***
	• *Learner is able **to use** relevant energy target-setting tools.*
	• ***Explain** the importance and **illustrate** processes of collecting energy targets for buildings, indoor environments and energy performance.*
	• *Ability to **explain and use** the key economic parameters: payback period, net present value, etc.*
	• *Learner is able to **explain and use** energy production/consumption methods.*
	• *Learner is able **to use** tools such as energy management software.*
	• *Can **consult** a BIM model and **exchang**e information in a BIM project.*
	• *Learner is **able to set** an energy efficiency intervention defined in its essential components in accordance with the needs and resources available.*
	• *Learner can **use** specific software and training in the use of innovative tools.*
	• *Learner has theoretical and practical **knowledge** aiming to understand use and limits of technologies.*
	• *Learner **has technical and theoretical knowledge**; the **ability to act** at the task level and to perform problem-solving.*
	• *Learner can make conscious **use** of computational software; **has understanding** of physical phenomena and conscious adoption of technically feasible solutions.*
Responsibility & Autonomy	
	• ***Learner is able to explain and use energy based collaboration methods for energy management and processes.***
	• ***Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.***
	• *Learner is able to **identify** factors that can positively influence the economic and energy efficiency of a building.*
	• *Learner **is able to set** energy efficiency improvement intervention, implemented, organised and monitored in accordance with the required standards.*
	• *Learner **is able to prefigure** possible intervention scenarios by assessing their feasibility and technical/economic viability.*
	• *Raise awareness actions on energy efficiency, **understanding** the needs of the territory and finding out technical and organizational synergies between its organization and the local needs.*
	• ***Iterate** the design solutions to meet the set targets of building performance and energy.*
	• *Learner is able to **interpret** correctly the legal framework for energy efficiency in buildings and also nZEBs.*

	• ***Adopt ways*** *for raising awareness about environmental issues related to climate change and sustainable development, promoting interventions with natural materials and low environmental impact.*
	• ***Transfer knowledge*** *about the technical-economic/commercial-environmental advantages of a project featured by technical solutions aimed at energy-environmental quality.*
	• *Learner is able to* ***identify*** *the specialties involved in the energy management procedures and provide quality assurance methods for these procedures.*
	• *Learner is able to* ***adopt techniques*** *and tools for the mantainance and management of technical systems, by identifying the best mix of resources, instruments, time and methodologies and to define a plan for the energy performance improvement.*
	• ***Develop*** *a strategy for multidisciplinary skills in the team*
	• ***Support*** *the process resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• *Learner is able to* ***promote*** *the benefits of managing building life cycle information through digital tools*
	• ***Demonstrate*** *how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.*
	• ***Demonstrate*** *the flow of design teamwork with use of void provision model together with architectural and structural design.*
	• *Learner is able to coordinate & manage the consistency of the BIM model*
	• ***Assist / participate*** *in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.*
	• ***Validate*** *and check compatibility of the domain model and manage and repair conflict.*
	• ***Verify*** *the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.*
	• ***Participate*** *in the verification of the achievement of the targeted result and undertake site inspections in construction site.*
	• ***Comment*** *product and system providers' designs and* ***comment*** *the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.*
	• ***Instruct*** *and audit contractors on construction site on critical points.*
	• ***Describe and assess*** *quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
	• ***Use*** *domain specific BIM authoring applications for building construction design and analysis.*
	• ***Use*** *relevant energy design calculations and assessment tools in different design phases.*
	• ***Use*** *different tools for BIM-based collaborative working.*
	• ***Create*** *combination model and use model checking tools for clash detection.*

	• ***Extract*** *energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.*
	• ***Use*** *relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.*
	• ***Prepare*** *the domain model for simulation and assessments*
	• ***Use*** *tools for environmental impact analyses.*
	• ***Use*** *project data and file management systems.*
	• *Learner has the ability* ***to use*** *software and tools; knowledge on new construction methodologies*
	• *Learner has the ability* ***to use*** *different software; contract management methodologies; specific regulations such has security and fire prevention.*
	• *Learner has* ***improved knowledge and*** *increased* ***ability to interact*** *with others in the design-management process of the building intervention.*
	• *Learner* ***is capable of collaboration, co-working and co-creation*** *in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration*
	• *Learner* ***has target setting competence****, competence on feasibility study to get realistic energy target values as well as competence of steering estimated energy efficiency target*
	• *Learner is* ***able to change management*** *during the procurement and assemply of HVAC and energy systems and to process competence*
	• *Learner is* ***competent on change management*** *of the targets of user groups or project partners, during design phase, as well as on the process*

Table 13 Profile for Client & Client Advisors

Architectural Design Roles	
Knowledge	
	• ***Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• ***Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.***
	• ***Recall*** *essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.*
	• ***Summarize*** *the ideas of digital space and asset management*
	• ***Distinguish*** *the level of passive performance*
	• ***Understand and know*** *the 4 performance criteria*
	• *Learner is able to* ***understand and describe*** *how to capitalize on passive energy gains.*

	• ***Explain*** *added value of sustainable energy efficient practices and sustainable projects.*
	• ***Explain*** *the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.*
	• ***Explain and give examples*** *of aspects and terminology related to energy interventions and building energy performance.*
	• ***Summarize and illustrate*** *the potentials of renewable energy sources including district-scale solutions.*
	• ***Explain*** *the core concepts of sustainable energy building rating and certification systems.*
	• ***Explain*** *the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.*
	• ***Explain*** *the European and national concepts of sustainable energy building rating and certification systems.*
	• ***Understanding*** *and ability to* ***explain*** *the role and importance of integrating different RES installations.*
	• ***Know*** *how to fill in the related data of the model correctly*
	• ***Know*** *the principles of BIM*
	• *Learner* ***understands*** *NZEB, circularity, and digitalization in construction*
	• *Learner* ***understands*** *more innovative concepts, like e.g: climate adaptation*
	• *Learner* ***knows*** *the international standards for energy certification*
	• *Learner* ***knows*** *general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase.*
Skills	
	• ***Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.***
	• ***Learner is able to use different relevant energy software and interfaces between relevant software.***
	• ***Learner is able to use*** *relevant energy target-setting tools.*
	• *Ability* ***to explain and use*** *the key economic parameters: payback period, net present value, etc.*
	• *Learner* ***is able to explain and use*** *energy production/consumption methods.*
	• ***Ability to perform*** *energy analyses including dynamic simulations.*
	• *Ability to* ***explain*** *and* ***use*** *the key economic parameters: payback period, net present value, etc.*
	• *Can* ***consult*** *a BIM model and* ***exchange*** *information in a BIM project.*
	• *Learner knows how to* ***apply*** *digital tools into the design phase, for courses on sustainability*
	• *Learner is able to* ***apply*** *BIM concepts in coordinating building energy performance optimization*

	• *Learner can* ***use*** *specific software and training in the use of innovative tools*
	• *Learner* ***knows*** *how to build components and how they must be used.*
	• *Learner has theoretical and practical* ***knowledge*** *aiming to understand use and limits of technologies.*
	• *Learner can make conscious* ***use*** *of computational software;* ***has understanding*** *of physical phenomena and conscious adoption of technically feasible solutions*
Responsibility & Autonomy	
	• ***Learner is able to explain and use energy based collaboration methods for energy management and processes.***
	• ***Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.***
	• ***Learner is able to use different energy tools for solving complex problems at the interface between domains.***
	• ***Identify*** *the services, methodologies (BIM) and people to constitute an operational team*
	• ***Presenting technical solutions*** *for eliminating thermal bridges in buildings.*
	• ***Being able to make structural choices, understanding*** *their impacts on thermal inertia, as well as life cycle impacts*
	• ***Ability to work collaboratively*** *with all project stakeholders: design team, clients, users, manufacturers, workers and building authorities.*
	• ***Validate and check compatibility*** *of the energy model and also* ***manage*** *and eliminate conflicts.*
	• *Learner is able to* ***design and create*** *models based on BIM software from an architectural point of view and to make energy analysis*
	• ***Master*** *the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.*
	• ***Understand*** *how to drastically reduce the losses of buildings.*
	• ***Manage techniques*** *for improving the building performance in terms of environmental comfort adopting advanced engineering systems (active, passive, mixed, hybrid systems.*
	• ***Develop*** *a strategy for multidisciplinary skills in the team*
	• ***Support*** *the process resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• ***Demonstrate*** *how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities*
	• ***Demonstrate*** *the flow of design teamwork with use of void provision model together with architectural and structural design*
	• ***Assist / participate*** *in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.*

	• ***Validate*** *and* ***check*** *compatibility of the domain model and manage and repair conflict.*
	• ***Verify*** *the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.*
	• ***Participate*** *in the verification of the achievement of the targeted result and undertake site inspections in construction site.*
	• ***Comment*** *product and system providers' designs and* ***comment*** *the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.*
	• ***Instruct*** *audit contractors on construction site on critical points.*
	• ***Describe*** *and* ***assess*** *quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
	• ***Evaluate*** *the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts*
	• ***Use*** *domain specific BIM authoring applications for building construction design and analysis.*
	• ***Use*** *relevant energy design calculations and assessment tools in different design phases.*
	• ***Use*** *different tools for BIM-based collaborative working.*
	• ***Create*** *combination model and* ***use*** *model checking tools for clash detection.*
	• ***Extrac****t energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.*
	• ***Use*** *relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.*
	• ***Prepare*** *the domain model for simulation and assessments*
	• ***Use*** *tools for environmental impact analyses.*
	• ***Use*** *project data and file management systems.*
	• *Learner has the ability* ***to use*** *software and tools; knowledge on new construction methodologies.*
	• *Learner is able to* ***enlarge*** *the range of the available technical solutions to solve possible issues*
	• *Learner has the ability* ***to use*** *different software; contract management methodologies; specific regulations such has security and fire prevention.*
	• *Learner has* ***improved knowledge and*** *increased* ***ability*** *to interact with others in the design-management process of the building intervention.*
	• *Learner* ***has the ability*** *to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and* ***evaluating*** *from time to time the appropriate solution.*

	• *Learner is **competent in demanding** energy design, estimation and **optimation** and **has knowledge** of primary energy sources and design competence of energy mix*
	• *Learner has **excellent knowledge** in BIM - based energy design and is **capable of** designs solution, calculation, simulations, optimation and standardisation of tools*
	• *Learner **has excellent skills in use** of energy design, simulation and optimation tools*
	• *Learner **is capable of collaboration, co-working and co-creation** in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration*
	• *Learner is **competent on change management** of the targets of user groups or project partners, during design phase, as well as on the process*

Table 14 Profile for Architectural Design Roles

	Structural Design Roles
Knowledge	
	• ***Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• ***Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.***
	• ***Recall essential contents, summarize and give examples** of energy interventions terminologies, definitions and standards.*
	• ***Explain added value** of sustainable energy efficient practices and sustainable projects.*
	• ***Summarize the ideas** of digital space and asset management.*
	• ***Explain the added value** of using energy model open file formats to ensure interoperability.*
	• ***Explain the main contents** and **apply relevant** parts of national energy guidelines.*
	• ***Explain and give examples** of aspects and terminology related to energy interventions and building energy performance.*
	• ***Describe the aspects** (financial and environmental) and energy related indicators and building performance.*
	• ***Explain relations** between life-cycle costs, energy performance and building performance.*
	• ***Summarize and illustrate the potentials** of renewable energy sources including district-scale solutions.*
	• ***List and explain the** core concepts of sustainable energy building rating and certification systems.*

	• ***Explain the potentials*** *of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.*
	• ***Explain the overall design*** *process for energy-efficient building.*
	• ***Explain how to support*** *owner's effective decision-making and opinion formation of other stakeholders.*
	• ***Illustrate how to direct*** *the design towards set targets utilizing the capacity of different kinds of assessment methods relevant for building construction design.*
	• ***Explain the flow*** *of design teamwork and* ***demonstrate how*** *to prepare, compare and improve alternative concepts.*
	• ***Learner is able to understand the interest*** *of integrating renewable energies into BIM (Building Information Modelling) models.*
	• ***Learner is able to understand*** *the impact of RE in BIM models.*
	• ***List*** *and* ***explain*** *indoor comfort criteria*
	• ***Describe*** *different solutions for improving the energy efficiency in buildings*
	• ***Know*** *how to fill in the related data of the model correctly*
	• ***Know*** *the principles of BIM*
	• *Learner* ***understands*** *NZEB, circularity, and digitalization in construction*
	• *Learner* ***understands*** *more innovative concepts, like e.g: climate adaptation*
	• *Learner* ***knows*** *the international standards for energy certification*
	• *Learner* ***knows*** *general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase.*
	• *Learner* ***knows*** *the international standards for energy certification.*
Skills	
	• ***Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.***
	• ***Learner is able to explain and use energy based collaboration methods for energy management and processes.***
	• ***Perform preliminary energy analysis*** *in the early project stages for both new and renovation projects to add value for the decision making.*
	• ***Apply the set performance targets*** *related to building design into BIM-based design process.*
	• ***Perform energy analyses*** *including dynamic simulations.*
	• ***Perform analyses*** *of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.*
	• ***Perform lightning calculations,*** *analyses and simulations.*
	• ***Use life cycle cost calculation*** *including life-cycle studies changing influential design parameters.*

	• ***Extract energy information*** *from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.*
	• ***Use relevant visualization*** *tools for visualizing design solutions and output from energy simulations, calculations.*
	• ***Use tools*** *for environmental impact analyses.*
	• ***Use project data*** *and file management systems.*
	• *Learner is able to* ***apply*** *BIM concepts in coordinating building energy performance optimization*
	• *Can* ***consult*** *a BIM model and* ***exchang****e information in a BIM project.*
	• ***Perform*** *energy analyses including dynamic simulations.*
	• ***Perform*** *analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.*
	• ***Perform*** *lightning calculations, analyses and simulations.*
	• ***Discuss*** *and* ***assess*** *the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.*
	• *Learner can* ***use*** *specific software and training in the use of innovative tools.*
	• *Learner* ***knows*** *how to build components and how they must be used*
	• *Learner has theoretical and practical* ***knowledge*** *aiming to understand use and limits of technologies.*
	• *Learner* ***has technical and theoretical knowledge;*** *the* ***ability to act*** *at the task level and to perform problem-solving.*
	• *Learner can make conscious* ***use*** *of computational software****; has understanding*** *of physical phenomena and conscious adoption of technically feasible solutions.*
	• *Learner* ***knows*** *the physical properties of materials and their correct use to determine an envelope's stratigraphy. Learner* ***has detailed knowledge*** *of systems functioning and interconnections.*
	• *Learner has technical physics* ***knowledge,*** *air-tightness principles, and materials knowledge along with BIM use to be able to interact organically with other professionals.*
Responsibility & Autonomy	
	• ***Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)***
	• ***Learner is able to use different relevant energy software and interfaces between relevant software.***
	• ***Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.***
	• ***Assist*** *client to set realistic and achievable energy and building performance target.*

	• ***Support the process*** *resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• ***Prepare/assist information*** *needed for specific use cases such as bill of quantities.*
	• ***Prepare/assist*** *the domain model for simulation and assessment.*
	• ***Prepare/assist*** *models and information for planning authority and in required data format.*
	• ***Prepare/assist*** *models and information for procurement and construction.*
	• ***Prepare models*** *to fulfil quality and information requirements for quality control and assurance processes in construction.*
	• ***Prepare models*** *based on data and information requirements of sustainable care and maintenance processes.*
	• ***Prepare information*** *for As-Built Models and Maintenance model for utilization of client and building management.*
	• ***Prepare/assist*** *in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performance requirements.*
	• ***Prepare relevant visualization models*** *to enable information sharing, decision making and opinion formation.*
	• ***Validate and check compatibility*** *of the domain model and manage and repair conflict.*
	• ***Verify the achievement*** *of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.*
	• ***Prepare*** *the Construction engineer's domain model on the basis of set targets and definitions given in architect's domain model.*
	• ***Assist*** *the client to set and specify information requirements and to compare between different structural solutions*
	• ***Lead / assist*** *the tasks related to technical documents for the building authorities.*
	• ***Create*** *different energy efficient design concepts renewable energy systems.*
	• ***Discuss and assess*** *the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.*
	• ***Share the results*** *of energy simulations, discuss the options and update domain BIMs*
	• ***Create and update*** *digital (BIM-linked) building specification with material and dimensional information to reflect owner's quality and performance requirements.*
	• ***Describe the*** *essential parts of the procedure for BIM based collaboration.*
	• ***Describe*** *different collaborative interdisciplinary and open BIM working methods, tools and processes.*

	• ***Demonstrate*** *how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.*
	• ***Demonstrate*** *the flow of design teamwork with use of void provision model together with architectural and structural design.*
	• ***Collaborate*** *with the help of communication platforms and processes.*
	• ***Assist / participate*** *in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.*
	• ***Participate*** *in the verification of the achievement of the targeted result and undertake site inspections in construction site.*
	• ***Comment*** *product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfilment of targets.*
	• ***Instruct*** *and audit contractors on construction site on critical points.*
	• ***Describe*** *and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
	• ***Describe*** *and assess the quality assurance procedures according to the stages of assembly of building elements and systems.*
	• ***Use*** *domain specific BIM authoring applications for building construction design and analysis.*
	• ***Use*** *relevant energy design calculations and assessment tools in different design phases.*
	• ***Use*** *different tools for BIM-based collaborative working.*
	• ***Create*** *combination model* ***and use*** *model checking tools for clash detection.*
	• ***Iterate*** *the design solutions to meet the set targets of building performance and energy efficiency.*
	• *Learner will* ***be able to be a player*** *in the evolution of BIM models towards BIM-GEM models (Management, Operation, Maintenance).*
	• ***Consider*** *options of renewable energy and optimize its potentials.*
	• ***Know the methods*** *of managing indoor air quality.*
	• ***Prepare*** *the domain model for simulation and* ***assessments***
	• ***Clarify and delegate*** *specific* ***responsibilities*** *in the execution of works*
	• ***Design solutions*** *upgradable to meet coming EE systems requirements (options for future EE improvements)*
	• ***Integration into public contracts*** *for new buildings and renovation*
	• ***Support*** *the process resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• ***Develop*** *a strategy for multidisciplinary skills in the teams*
	• ***Clarify*** *and* ***delegate*** *specific responsibilities in the execution of works*
	• ***Evaluate*** *the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts*
	• ***Use*** *tools for environmental impact analyses.*
	• *Learner has the ability* ***to use*** *software and tools; knowledge on new construction methodologies.*

	• *Learner is able to **enlarge** the range of the available technical solutions to solve possible issues.*
	• *Learner has the ability **to use** different software; contract management methodologies; specific regulations such has security and fire prevention.*
	• *Learner has i**mproved knowledge and** increased **ability** to interact with others in the design-management process of the building intervention.*
	• *Learner **has the ability** to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and **evaluating** from time to time the appropriate solution.*
	• *Learner is **competent in demanding** energy design, estimation and **optimation** and **has knowledge** of primary energy sources and design competence of energy mix*
	• *Learner has **excellent knowledge** in BIM - based energy design and is **capable of** designs solution, calculation, simulations, optimation and standardisation of tools*
	• *Learner **has excellent skills in use** of energy design, simulation and optimation tools*
	• *Learner **is capable of collaboration, co-working and co-creation** in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration*
	• *Learner is **competent on change management** of the targets of user groups or project partners, during design phase, as well as on the process*

Table 15 Profile for Structural Design Roles

Building Services Design Roles	
Knowledge	
	• ***Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• ***Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.***
	• ***Know the sources** of indoor pollutants, ventilation systems and air treatment.*
	• ***Know the health** and economic issues related to good IAQ.*
	• ***Know the regulations** regarding IAQ and ventilation in buildings.*
	• ***Know** the rules for the design, sizing and implementation of a residential ventilation system.*

	• ***Recognize*** *the pathologies and implementation faults and* ***know*** *how to apprehend their impacts.*
	• ***Know*** *the keys to a successful ventilation and IAQ audit.*
	• ***Know*** *the principles of measurement, methods of analysis, measurement protocols and sampling methods*
	• ***Knowledge*** *of different situations when ventilation airflow can be limited/increased*
	• ***Knowledge*** *of the factors that influence a ventilation system*
	• ***Know*** *the principles of safety, reliability, energy efficiency and environmental impact underlying the management of the systems*
	• *Learner* ***understands*** *NZEB, circularity, and digitalization in construction*
	• *Learner* ***understands*** *more innovative concepts, like e.g: climate adaptation*
	• ***Know*** *the principles of BIM*
	• *Learner* ***knows*** *the international standards for energy certification*
	• *Learner* ***knows*** *general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase.*
Skills	
	• ***Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.***
	• ***Know*** *how to fill in the related data of the model correctly*
	• *Can* ***consult*** *a BIM model and exchange information in a BIM project.*
	• ***Perform*** *energy analyses including dynamic simulations.*
	• ***Perform*** *analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.*
	• ***Perform*** *lightning calculations, analyses and simulations.*
	• ***Discuss*** *and* ***assess*** *the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.*
	• ***Perform*** *energy analyses including dynamic simulations.*
	• ***Perform*** *analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.*
	• ***Perform*** *lightning calculations, analyses and simulations.*
	• ***Discuss*** *and* ***assess*** *the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.*
	• *Learner can* ***use*** *specific software and training in the use of innovative tools.*

	• *Learner **knows** how to build components and how they must be used.*
	• *Learner has theoretical and practical **knowledge** aiming to understand use and limits of technologies.*
	• *Learner **has technical and theoretical knowledge**; the **ability to act** at the task level and to perform problem-solving.*
	• *Learner can make conscious **use** of computational software; **has understanding** of physical phenomena and conscious adoption of technically feasible solutions.*
	• *Learner has technical physics **knowledge,** air-tightness principles, and materials knowledge along with BIM use to be able to interact organically with other professionals.*
	• *Learner has **excellent knowledge** in BIM - based energy design and is **capable of** designs solution, calculation, simulations, optimation and standardisation of tools*
Responsibility & Autonomy	
	• ***Learner is able to explain and use energy based collaboration methods for energy management and processes.***
	• ***Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.***
	• ***Find avenues** for improving IAQ.*
	• ***Know** the **method**s of managing indoor air quality.*
	• *Learner is able to **use different approaches** and features in creating models of energy consumption of buildings for the heating and cooling periods.*
	• ***Know** the **methods** of managing indoor air quality and the methods for calculating thermal loads.*
	• ***Provide documentation** on the project by means of calculation reports and graphics (plans, sections, functional diagrams, etc.).*
	• ***Support** the process resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• *Learner is able to **find** solutions to optimize the energy usage based for example on the electricity spot -prises and delivery from solar panels.*
	• *Learner is able to **promote** the benefits of managing building life cycle information through digital tools*
	• ***Demonstrate** how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.*
	• ***Demonstrate** the flow of design teamwork with use of void provision model together with architectural and structural design.*
	• ***Assist / participate** in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.*
	• ***Validate and check** compatibility of the domain model and manage and repair conflict.*

	• ***Verify*** *the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.*
	• ***Participat****e in the verification of the achievement of the targeted result and undertake site inspections in construction site.*
	• ***Comment*** *product and system providers' designs and* ***comment*** *the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.*
	• ***Instruct*** *audit contractors on construction site on critical points.*
	• ***Describe*** *and* ***assess*** *quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
	• ***Evaluate*** *the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts*
	• ***Use*** *domain specific BIM authoring applications for building construction design and analysis.*
	• ***Use*** *relevant energy design calculations and assessment tools in different design phases.*
	• ***Use*** *different tools for BIM-based collaborative working.*
	• ***Create*** *combination model and use model checking tools for clash detection.*
	• ***Extract*** *energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.*
	• ***Use*** *relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.*
	• ***Prepare*** *the domain model for simulation and assessments*
	• ***Use*** *tools for environmental impact analyses.*
	• ***Use*** *project data and file management systems.*
	• *Learner has the ability* ***to use*** *software and tools; knowledge on new construction methodologies.*
	• *Learner has the ability* ***to use*** *different software; contract management methodologies; specific regulations such has security and fire prevention.*
	• *Learner has* ***improved knowledge and*** *increased* ***ability*** *to interact with others in the design-management process of the building intervention.*
	• *Learner* ***has the ability*** *to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and* ***evaluating*** *from time to time the appropriate solution.*
	• *Learner* ***has excellent skills in use*** *of energy design, simulation and optimation tools*
	• *Learner* ***is capable of collaboration, co-working and co-creation*** *in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration*

Table 16 Profile for Building Services Design Roles

	Construction Work Roles
Knowledge	
	• ***Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• ***Acquire the basics*** *of efficient rehabilitation.*
	• ***Know the keys*** *to renovating an existing building at low consumption level.*
	• ***Recall essential*** *contents,* ***summarize*** *and* ***give examples*** *of energy interventions terminologies, definitions and standards.*
	• ***Explain*** *added value of sustainable energy efficient practices and sustainable projects.*
	• ***Explain*** *the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.*
	• ***Explain*** *the main contents and* ***apply relevant parts*** *of national energy guidelines.*
	• ***Understand*** *the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.*
	• ***Understand*** *that there is a market to seize and record the elements that will help to find its place there.*
	• ***Understand*** *the benefits of effective rehabilitation and its opportunities for professionals.*
	• ***Understanding*** *and application of new working methods, regulations and outlooks on effective rehabilitation.*
	• ***Explain*** *the importance efficient rehabilitation and low consumption level.*
	• ***Know the principles*** *of measurement, methods of analysis of heat low from buildings.*
	• ***Know the principles*** *of organization of spaces, ventilation, air tightness and humidity management.*
	• ***Know the principles*** *of wall insulation, thermal bridges and thermal comfort.*
	• ***Know the principles*** *of heating and domestic hot water and lighting and electrical equipment specifically in old houses.*
	• ***Knowledge*** *of the basic requirements for safety, occupational health and fire protection*
	• *Learner is able to* ***identify*** *the critical features of buildings with low consumption*

	• ***Knowledge*** *of the standards for thermal comfort*
	• ***Understanding*** *the principles for achieving high thermal performance envelopes*
	• *Ability to* ***read*** *working drawings, assembly plans and specifications.*
	• ***Know*** *how to fill in the related data of the model correctly*
	• ***Know*** *the principles of BIM*
	• *Construction workers* ***understands*** *the correct installation for the product of the system*
	• *Learner* ***know****s the international standards for energy certification*
	• *Can* ***consult*** *a BIM model and exchange information in a BIM project.*
	• *Learner* ***knows*** *general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase.*
Skills	
	• ***Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.***
	• ***Learner is able to explain and use energy-based collaboration methods for energy management and processes.***
	• ***Testing*** *thermo-hydraulic systems in accordance with efficiency and safety standards*
	• *Contractor* ***knows*** *how to execute energy efficiency*
	• *Learner can* ***use*** *specific software and training in the use of innovative tools.*
	• *Learner has theoretical and practical* ***knowledge*** *aiming to understand use and limits of technologies.*
	• *Learner* ***has technical and theoretical knowledge****; the* ***ability to act*** *at the task level and to perform problem-solving.*
	• *Learner can make conscious* ***use*** *of computational software****; has understanding*** *of physical phenomena and conscious adoption of technically feasible solutions.*
Autonomy	
	• *Ability to* ***evaluate*** *the performance of an envelope element, knowledge of the typical values and the effects they have on the thermal comfort, thermal bridges*
	• ***Develop*** *a strategy for multidisciplinary skills in the team*
	• ***Support*** *the process resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• ***Demonstrate*** *how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.*
	• ***Demonstrate*** *the flow of design teamwork with use of void provision model together with architectural and structural design.*
	• ***Assist / participate*** *in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule*

	• ***Validate and check*** *compatibility of the domain model and manage and repair conflict.*
	• ***Verify*** *the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.*
	• ***Participate*** *in the verification of the achievement of the targeted result and undertake site inspections in construction site.*
	• ***Comment*** *product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.*
	• ***Instruct*** *and* ***audit*** *contractors on construction site on critical points.*
	• ***Describe and assess*** *quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
	• ***Describe and assess*** *quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
	• ***Use*** *domain specific BIM authoring applications for building construction design and analysis.*
	• ***Use*** *relevant energy design calculations and assessment tools in different design phases.*
	• ***Use*** *different tools for BIM-based collaborative working.*
	• ***Create*** *combination model and use model checking tools for clash detection.*
	• ***Extract*** *energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM*
	• ***Use*** *relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.*
	• ***Prepare*** *the domain model for simulation and assessments*
	• ***Use*** *tools for environmental impact analyses.*
	• ***Use*** *project data and file management systems.*
	• *Learner has the ability* ***to use*** *software and tools; knowledge on new construction methodologies.*
	• *Learner has the ability* ***to use*** *different software; contract management methodologies; specific regulations such has security and fire prevention*
	• *Learner has* ***improved knowledge and*** *increased* ***ability*** *to interact with others in the design-management process of the building intervention.*
	• *Learner* ***has the ability*** *to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) and* ***evaluating*** *from time to time the appropriate solution.*

	• *Learner **is capable of collaboration, co-working and co-creation** in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration*
	• *Learner is **able to change management** during the procurement and assemply of HVAC and energy systems and to process competence*

Table 17 Profile for Construction Work Roles

	Maintenance Work Roles
Knowledge	
	• ***Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.***
	• ***Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.***
	• ***Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.***
	• *Learner **understands** NZEB, circularity, and digitalization in construction*
	• ***Know** how to fill in the related data of the model correctly*
	• ***Know** the principles of BIM*
	• *Learner **knows** the international standards for energy certification*
	• *Learner **knows** general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase.*
	• ***Acquire** the basics of renovation and energy performance.*
	• ***Know** the different stages of a renovation project.*
	• ***Understand** the different roles of each: Syndic, union council, AMO, …*
Skills	
	• ***Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project-based energy targets.***
	• *Can **consult** a BIM model and exchange information in a BIM project.*
	• *Learner is able to **use** of new materials / technics in renovation.*
	• *Learner can **use** specific software and training in the use of innovative tools.*
	• *Learner **knows** how to build components and how they must be used.*
	• *Learner has theoretical and practical **knowledge** aiming to understand use and limits of technologies.*
	• *Learner **has technical and theoretical knowledge;** the **ability to act** at the task level and to perform problem-solving.*

	• *Learner can make conscious **use** of computational software**; has understanding** of physical phenomena and conscious adoption of technically feasible solutions*
Responsibility & Autonomy	
	• ***Learner is able to use different relevant energy software and interfaces between relevant software.***
	• ***Learner is able to use different relevant energy software and interfaces between relevant software.***
	• ***Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)***
	• ***Inform** and **raise awareness** among the tenants and the owners on the range of technical, economic and managing opportunities for an energy efficient renovation of the concerned building*
	• *To be able to **collect the data** necessary for the good start of the project and to know how to use an audit*
	• *Basic **knowledge** on **conflict management***
	• ***Knowledge** on how to **interpret** the energy audit and energy certificate of a building.*
	• *Be able to **collect different documentation** aiming at requiring financing and incentives*
	• ***Know** how to order a quality project management.*
	• *To be able to **collect** the data necessary for the good start of the project and to know how to use an audit.*
	• ***Evaluate** the potential of the co-ownership and be able to unite around the issue of renovation.*
	• ***Know** the different types of financing and be able to express yourself on this subject.*
	• ***Knowing how** to identify the needs and challenges of the co-ownership in terms of renovation.*
	• *Learner is able to **promote** the benefits of managing building life cycle information through digital tools*
	• *Learner **is familiar with** most common tools and methods for quality checks such as energy performance surveys and corresponding energy certificates*
	• ***Develop** a strategy for multidisciplinary skills in the team*
	• ***Support** the process resulting in the publication of the merged model (As-Designed) together with all needed information.*
	• ***Demonstrate** how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.*
	• ***Demonstrate** the flow of design teamwork with use of void provision model together with architectural and structural design.*
	• ***Learner is able to use different relevant energy software and interfaces between relevant software.***

[redacted]	• ***Assist / participate*** *in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule*
[redacted]	• ***Validate*** *and* ***check*** *compatibility of the domain model and manage and repair conflict.*
[redacted]	• ***Verify*** *the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.*
[redacted]	• ***Participate*** *in the verification of the achievement of the targeted result and undertake site inspections in construction site.*
[redacted]	• ***Comment*** *product and system providers' designs and* ***comment*** *the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.*
[redacted]	• ***Instruct*** *and audit contractors on construction site on critical points.*
[redacted]	• ***Describe*** *and* ***assess*** *quality assurance methods for energy-efficient building solutions to verify achievement of set targets.*
[redacted]	• ***Evaluate*** *the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts*
[redacted]	• *Learner is able to* ***use*** *different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)*
[redacted]	• ***Use*** *domain specific BIM authoring applications for building construction design and analysis.*
[redacted]	• ***Use*** *relevant energy design calculations and assessment tools in different design phases.*
[redacted]	• ***Use*** *different tools for BIM-based collaborative working.*
[redacted]	• ***Create*** *combination model and use model checking tools for clash detection.*
[redacted]	• ***Extract*** *energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.*
[redacted]	• ***Use*** *relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.*
[redacted]	• ***Use*** *relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.*
[redacted]	• ***Prepare*** *the domain model for simulation and assessments*
[redacted]	• ***Use*** *tools for environmental impact analyses.*
[redacted]	• ***Use*** *project data and file management systems.*
[redacted]	• *Learner has the ability* ***to use*** *software and tools; knowledge on new construction methodologies*
[redacted]	• *Learner is able to* ***enlarge*** *the range of the available technical solutions to solve possible issues*
[redacted]	• *Learner has the ability* ***to use*** *different software; contract management methodologies; specific regulations such has security and fire prevention*
[redacted]	• *Learner has* ***improved knowledge and*** *increased* ***ability*** *to interact with others in the design-management process of the building intervention*

[redacted]	• *Learner* ***has high quality*** *facility* ***management*** *and efficient energy* ***abilities.*** *They have* ***knowledge and skills*** *for automated building service systems operations, "running " the building*
[redacted]	• *Learner* ***has competence*** *on space usage change management during use of building and on the process*
[redacted]	• *Learner* ***is capable of collaboration, co-working and co-creation*** *in integrated processes, has competence in steering of collaboration and has skills and competence in virtual collaboration*
[redacted]	• *Learner* ***has target setting competence****, competence on feasibility study to get realistic energy target values as well as competence of steering estimated energy efficiency target*

Table 18 Profile for Maintanance Work Roles

Chapter 9. Conclusions

This report presents a first version of EU wide learning outcomes defined and developed for selected roles and activities related to energy efficiency education. Due focus was provided towards the EQF and its relative knowledge, skills and competencies based on the partner organizations.

During this procedure, national guides for plans of works for different roles and national guides for common energy requirements were made use of in defining phases, tasks and roles. For example in Finland guides for plan-of-work were formulated for architectural design, structural design, HVAC/MEP design, and management of building projects. In addition learning outcomes from previous stages of INSTRUCT and other relevant EE EU-projects were made use of in harmonizing the established European level frameworks.

Construction industry and building projects has several roles and stakeholders. To define the European learning outcomes related to BIM and energy-efficient building, six categories were selected:

- Client & Clients advisors
- Architectural design roles
- Structural design roles
- Building services design roles
- Construction work roles
- Maintenance work roles

The learning outcomes include requirements about understanding of energy education terminologies and definitions, processes and technologies and relevant guidelines for building information modelling. In addition, the learning outcomes also include requirements about performance based building and the factors that have direct and indirect impacts. Although this work focuses on energy-efficiency, it is important to simultaneously pay attention to other important performance aspects. When designing and operating low energy buildings, energy consumption is never a separate aspect but is always closely linked to the aspects of indoor environment. Thus learning outcomes for the management of energy performance need to consider the overall building performance.

The deliverable has been structured in three phases, which are reflected in Chapters 5 and Chapter 6. Through a process of consulting the INSTRUCT consortium and partners accross 8 EU countries, it presents an incrementative elaboration of the Learning Outcomes Tables and hopes to present a better picture of the current landscape of needs of needed training in the construction sector.

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11. Appendix A

11.1 North EU Demo

11.1.1 Finland – RIL

The insights refer to the second stage and are based on the Finnish point of view, based on previous experience and stakeholders' interviews.

Table 1: European EE learning outcome matrix for Client & Client advisors i.e. Client & Project manager, manager, coordinator, briefing consultant.

No	Table 1: Country specific learning outcome and qualifications	EQF LEVEL			
Client & Client advisors Client & Project manager *(C),* Energy manager *(EM),* Energy coordinator *(BC),* briefing consultant *(Bc)*		*C*	*EM*	*EC*	*Bc*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**4**	**5**	**5**	**5**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	5	5	4
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	2	3	3	3

1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance. 0	3	3	3	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**6**	**6**	**6**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	2	3	2	2
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	2	4	4	2
2.3	Explain relations between life-cycle costs, energy performance and building performance.	2	3	3	2
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**2**	**2**	**2**	**2**
3.1	Learner is able to use relevant energy target-setting tools.	2	2	2	2
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**2**	**3**	**3**	**2**
4.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	2	3	3	2
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**2**	**3**	**3**	**2**
5.1	Learner is able to explain and use energy production/consumption methods.	3	4	4	3
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**	**2**	**2**
6.1	Learner is able to use tools such as energy management software.	2	2	2	2

Table 1: European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)

No	Table 2: Country specific learning outcome and qualifications	EQF LEVEL		
Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer *(CD),* Architect *(ARCH),* Assistant designer *(ASS)*		*CD*	*ARCH*	*ASS*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	6	6	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	6	6	5
1.3	Summarize the ideas of digital space and asset management.	6	6	6

1.4	Explain the European and national concepts of sustainable energy building rating and certification systems.	4	4	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**5**	**5**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	6	5	5
2.2	Distinguish the level of passive performance	6	6	6
2.3	Understand and know the 4 performance criteria	6	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**4**
3.1	Learner is able to understand and describe how to capitalize on passive energy gains.	5	5	4
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**4**	**4**	**3**
4.1	Learner is able to use relevant energy target-setting tools.	4	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**6**	**6**	**5**
5.1	Learner is able to explain and use energy production/consumption methods.	6	5	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**6**	**6**	**6**
6.1	Identify the services, methodologies (BIM) and people to constitute an operational team	6	6	6
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**6**	**6**	**6**
7.1	Master the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.	6	6	6
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains.**	3	3	2
8.1	Understand how to drastically reduce the losses of buildings. (sounds like a complex problem-but not sure)	6	5	5

Table 3 European wide EE learning outcome matrix for structural design roles i.e. Structural design and coordinator (structural), Assistant designer

No	Table 3: Country specific learning outcome and qualifications	EQF Level		
Structural design roles Structural engineering design Magister *(SED), Construction Management* (Bachelor), *Project Management in Construction (Master)*		*SED*	*CM*	*PMC*

LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	-	-	-
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	4	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	3	4	5
1.3	Summarize the ideas of digital space and asset management.	2	2	2
1.4	Explain the added value of using energy model open file formats to ensure interoperability.	2	2	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3	4
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	-	-	-
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	4	5	6
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	4	5	6
2.3	Explain relations between life-cycle costs, energy performance and building performance.	5	5	6
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	4	4	5
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	3	3	4
2.6	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	4	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	-	-	-
3.1	Explain the overall design process for energy-efficient building.	3	4	5
3.2	Assist client to set realistic and achievable energy and building performance target.	3	4	5
3.3	Perform preliminary energy analysis in the early project stages for both new and renovation projects to add value for the decision making.	4	4	5
3.4	Assist the client to set and specify information requirements.	4	4	5
3.5	Explain how to support owner's effective decision-making and opinion formation of other stakeholders.	4	4	5
3.6	Illustrate how to direct the design towards set targets utilizing the capacity of different kinds of assessment methods relevant for building construction design.	5	5	6
3.7	Explain the flow of design teamwork and demonstrate how to prepare, compare and improve alternative concepts.	5	5	6
3.8	Lead / assist the tasks related to technical documents for the building authorities.	6	5	6

LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	-	-	-
4.1	Apply the set performance targets related to building design into BIM-based design process.	4	4	4
4.2	Iterate the design solutions to meet the set targets of building performance and energy efficiency.	4	4	4
4.3	Consider options of renewable energy and optimize its potentials.	3	3	4
	Design solutions upgradable to meet coming EE systems requirements (options for future EE improvements)	3	3	3
4.4	Create different energy efficient design concepts renewable energy systems.	3	4	4
4.5	Perform energy analyses including dynamic simulations.	2	2	2
4.6	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2	2	2
4.7	Perform lightning calculations, analyses and simulations.	2	2	2
4.8	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4	5	5
4.9	Use life cycle cost calculation including life-cycle studies changing influential design parameters.	5	4	5
4.10	Share the results of energy simulations, discuss the options and update domain BIMs.	4	3	4
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	-	-	-
5.1	Prepare the Construction engineer's domain model on the basis of set targets and definitions given in architect's domain model.	6	3	4
5.2	Create and update digital (BIM-linked) building specification with material and dimensional information to reflect owner's quality and performance requirements.	4	3	4
5.3	Explain essential issues of the needs of initial information and the potentials of different inventory surveys in refurbishment projects.	5	4	5
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4
5.5	Prepare/assist information needed for specific use cases such as bill of quantities.	6	5	6
5.6	Prepare/assist the domain model for simulation and assessment.	5	4	5
5.7	Prepare/assist models and information for planning authority and in required data format.	4	3	4
5.8	Prepare/assist models and information for procurement and construction.	5	4	5
5.9	Prepare models to fulfil quality and information requirements for quality control and assurance processes in construction.	5	4	5

5.10	Prepare models based on data and information requirements of sustainable care and maintenance processes.	4	4	5
5.11	Prepare information for As-Built Models and Maintenance model for utilization of client and building management.	4	4	5
5.12	Prepare/assist in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performance requirements.	5	4	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	-	-	-
6.1	Describe the essential parts of the procedure for BIM based collaboration.	4	4	5
6.2	Describe different collaborative interdisciplinary and open BIM working methods, tools and processes.	4	4	5
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	4	4	5
6.4	Prepare relevant visualization models to enable information sharing, decision making and opinion formation.	5	4	5
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	6	5	6
6.6	Collaborate with the help of communication platforms and processes.	6	5	6
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	-	-	-
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	4	3	4
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	4	3	4
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	5	3	4
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	5	4	5
7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	4	3	4
7.6	Instruct and audit contractors on construction site on critical points.	6	4	5
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	4	3	4
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	-	-	-
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	6	4	4

8.2	Use relevant energy design calculations and assessment tools in different design phases.	2	3	3
8.3	Use different tools for BIM-based collaborative working.	5	4	5
8.4	Create combination model and use model checking tools for clash detection.	4	3	4
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	3	3	4
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	5	3	4
8.7	Prepare the domain model for simulation and assessments	4	3	4
8.8	Use tools for environmental impact analyses.	3	3	4
8.9	Use project data and file management systems.	5	4	5

Table 2 European EE learning outcome matrix for building service design roles i.e. HVAC and energy design and coordinator (HVAC), assistant designer

No	Table 4: Country specific learning outcome and qualifications	EQF Level	
	Building services design roles HVAC and energy design *(HVAC+E)* and Energy coordinator (HVAC), assistant designer *(ASS)*	*HVAC +E*	*ASS*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	7
1.2	Know the health and economic issues related to good IAQ.	7	7
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**
2.1	Know the regulations regarding IAQ and ventilation in buildings.	6	6
2.2	Know the rules for the design, sizing and implementation of a residential ventilation system.	6	6
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**4**	**3**
3.1	Know the keys to a successful ventilation and IAQ audit.	5	5
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**3**	**3**

4.1	Know the principles of measurement, methods of analysis, measurement protocols and sampling methods.	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**3**	**2**
5.1	Find avenues for improving IAQ.	5	4
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**
6.1	Know the methods of managing indoor air quality.	5	5

Table 5 European wide EE learning outcome matrix for Construction work roles i.e. Site manager, Construction site workers and installers

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
Construction work roles Site manager *(SM),* Construction site workers and installers *(CW)*		*SM*	*CW*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**4**
1.1	Acquire the basics of efficient rehabilitation.	6	6
1.2	Know the keys to renovating an existing building at low consumption level.	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**4**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	5

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Acquire the basics of efficient rehabilitation.	6	6

1.2	Know the keys to renovating an existing building at low consumption level.	6	5
1.3	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	5	4
1.4	Explain added value of sustainable energy efficient practices and sustainable projects.	4	4
1.5	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**3**	**2**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	4
2.3	Understand the benefits of effective rehabilitation and its opportunities for professionals.	5	5
2.4	Understanding and application of new working methods, regulations and outlooks on effective rehabilitation.	4	4
LO3	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**4**
3.1	Explain the importance efficient rehabilitation and low consumption level.	**5**	**5**
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**
4.1	Know the principles of measurement, methods of analysis of heat low from buildings. (LO6?)	**5**	**5**
4.2	Know the principles of organization of spaces, ventilation, air tightness and humidity management. (LO6?)	**5**	**5**
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**	**5**	**5**
5.1	Know the principles of wall insulation, thermal bridges and thermal comfort.	**5**	**5**
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**4**	**4**
6.1	Know the principles of heating and domestic hot water and lighting and electrical equipment specifically in old houses.	**4**	**4**

Table 3 European EE learning outcome matrix for Maintenance work roles i.e. Maintenance operator, Property manager, Care taker

No	Table 6: Country specific learning outcome and qualifications	,EQF Level

Maintenance work roles Maintenance operator *(MO)*, Property manager *(PM)*, Care taker *(CT)*		*MO*	*PM*	*CT*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Knowing how to identify the needs and challenges of the co-ownership in terms of renovation.	6	6	5
1.2	Acquire the basics of renovation and energy performance.	6	6	5
1.3	Know the different stages of a renovation project.	6	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**	**6**
2.1	Evaluate the potential of the co-ownership and be able to unite around the issue of renovation.	5	4	4
2.2.1	To be able to collect the data necessary for the good start of the project	5	5	4
2.3	To know how to use an audit.			
2.4	Understand the different roles of each: Syndic, union council, AMO, …	6	6	5
2.4	Know how to order a quality project management.	6	6	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**5**
3.1	Know the different types of financing and be able to express yourself on this subject.	5	5	4
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**	**5**
4.1	Know how to mobilize before the general assembly.	5	5	5
4.2	Know the procedure to follow for a calm and legally unchallengeable vote on the work.	5	5	4
4.3	To be able to follow the work: understand the role of each person and ensure the proper conduct of the site.	5	5	4

11.1.2 Finland – VTT

Suggestions were received to be included, in terms of the structure of the tables and their content : Every role should have their own table: this would help the use of tables during the competence verification in bidding phase and in qualification systems. Important competence areas in the key roles

- clients Energy Manager
- who is estimating the energy mix and setting energy efficiency target (E- label)
  chief designer
- who is coordinating the design team for finding the best EE-solutions
- making sure that BIM process (EE simulations) is supporting the designers best way
  designer/ expert in charge of the sustainability assessment
- new skills description needed here. This is usually a professional, client will procure
- using LEVELS or national systems
  experts providing EPC calculations
- more tasks will probably come to the EPC experts

managers and foremen of using building service automation systems
- new skills description needed"

11.2 Central EU Demo

11.2.1 Poland – ASM

Updates will be received in the following months, after the development of the Pilots. In the immediate future, a workshop will take place in workshop in Warsaw on 19th January 2021, expecting attendance of 20 people (from the Polish window/door association company list) Its objective will be the identification of existing and foreseen partnership in the Polish window/door sector. Interviews will be held before the workshop. The content will include:
1h – round table presentation of the present people and INSTRUCT project presentation
3h – focused on the topic :

- Presentation of the building sector market status of 2021
- Description and discussion of people needs in terms of partnership, trainings and skills, what are the barriers.

11.3 West EU Demo

11.3.1 Luxembourg – LIST

Updates will be received in the following months, after the development from the Demonstration Pilots. A questionnaire was developed in collaboration with partners, to assist in the demonstration pilots.

11.3.2 Cardiff – CU

Cardiff University's contribution can be seen in Phase 3.

11.4 South Europe

11.4.1 Italy – DTTN

The following changes of the tables refer to the second phase, based on the Italian national/regional levels. The insights draw generally upon a) different Regional Qualification Frameworks of interest for specific professional profiles. These profiles are included in the footnotes at the bottom of each page b) University classes and trainings whose details are attached following the respective table. One limitation is that it was quite hard to find specific references which could fit well inside the matrix. Moreover, the EQF system is still rarely used in Italy, therefore some of the EQF levels included are based on approximation.
For the third phase, no changes are foreseen, at that moment. New insights will also take place from Demo 4.5 activities scheduled for the beginning of 2022, as follows:

Online workshop with R2M: This activity is scheduled for next February. Main topics to be covered have been found (timber buildings, related certifications and case studies on energy refurbishment) as well as the target group to address - this time professionals from the timber sector. The workshop will also be the occasion to create a link between DTTN previous Superbonus 110% events and R2M ongoing EU Lightness project, where smart and EE renovation is at the core.
Instruct event for professionals at Klimahouse Fair (Bozen): The Fair should have taken place at the end of January, but unfortunately it has been postponed to May 2022 a few days ago due to the Covid-19 emergency.
Preliminary contacts with condominium administrators: Contact was made with regional branch of the national association representing these professionals to work at a possible event-events cycle related to Instruct topics.Possible topics emerged after a brainstorming: EE guidelines related to Superbonus 110% (this time in a more technical way); green building sustainability rating systems. Feedback is expected in the following weeks.
Making of T3.5 survey for tenants/homeowners: A draft of possible questions has been recently sent to LIST to feed into a survey. The proposal mainly stemmed from our 2 events with homeowners. When finalized, I the tool could be useful to explore indirectly the EE skills aspects, by collecting inputs from the end users.

Table 1: European EE learning outcome matrix for Client & Client advisors i.e. Client & Project manager, manager, coordinator, briefing consultant.

No	Table 1: Country specific learning outcome and qualifications	EQF LEVEL			
Client & Client advisors Client & Project manager *(C),* Energy manager *(EM),* Energy coordinator *(BC),* briefing consultant *(Bc)*		*C*[1]	*EM*[2]	*EC*[3]	*Bc*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**7**	**6**	
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	6	7	6	
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	6	7	6	
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	6	7	6	

[1] The Los included draw upon the Latium Regional Framework of Qualifications for the profile of «Expert in energy-environmental qualification of construction companies» : https://www.regione.lazio.it/enti/formazione/profili-professionali/dettaglio/200
[2] The LOs included draw upon the Emilia-Romagna Regional Framework of Qualifications for the profile of “Technical expert in energy management”: https://orienter.regione.emilia-romagna.it/qualifica/dettaglio/298
[3] The Los included draw upon the Latium Regional Framework of Qualifications for the profile of «Expert in energy efficiency solutions for buildings»: https://www.regione.lazio.it/enti/formazione/profili-professionali/dettaglio/183

LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**7**	**6**	
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	6	7	6	
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	6	7	6	
2.3	Explain the energy state of art of buildings (organisational, economic, technical and behavioural variables) surveyed and mapped in terms of energy needs, use and cost	-	7	-	
2.4	Raise awareness actions on energy efficiency, understanding the needs of the territory and finding out technical and organizational synergies between its organization and the local needs	-	7	-	
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**-**			
3.1	Learner is able to use relevant energy target-setting tools.	-	7	6	
3.2	Learner is able to set an energy efficiency intervention defined in its essential components in accordance with the needs and resources available.	-	7	6	
3.3	Lerner is able to set energy efficiency improvement intervention, implemented, organised and monitored in accordance with the required standards.	-	7	-	
3.4	Learner is able to prefigure possible intervention scenarios by assessing their feasibility and technical/economic viability			6	
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**				
4.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	6	7	-	
4.2	Adopt ways for raising awareness about environmental issues related to climate change and sustainable development, promoting interventions with natural materials and low environmental impact	6	-	-	
4.3	Transfer knowledge about the technical-economic/commercial-environmental advantages of a project featured by technical solutions aimed at energy-environmental quality	6	-	-	
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**				
5.1	Learner is able to explain and use energy production/consumption methods.	-	7	-	
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**				
6.1	Learner is able to use tools such as energy management software.	-	7	6	
6.2	Learner is able to adopt techniques and tools for the mantainance and management of technical systems, by identifying the best mix of resources, instruments, time and methodologies and to define a plan for the energy performance improvement	-	-	6	

Table 4: European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)

No	Table 2: Country specific learning outcome and qualifications	EQF LEVEL		
	Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer *(CD)*, Architect *(ARCH)*, Assistant designer *(ASS)*	*CD*	*ARCH*[4]	*ASS*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	-	**8**	-
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.		8	
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.		8	
1.3	Summarize the ideas of digital space and asset management.		8	
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**			
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.		8	
2.2	Distinguish the level of passive performance		8	
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**		**8**	
3.1	Learner is able to understand and describe how to capitalize on passive energy gains.		8	
3.2	Manage techniques for improving the building performance in terms of environmental comfort adopting advanced engineering systems (active, passive, mixed, hybrid systems		8	
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**		**8**	
4.1	Learner is able to use relevant energy target-setting tools.		8	
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**			
5.1	Learner is able to explain and use energy production/consumption methods.		8	
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**		**8**	

[4] The new Los included and the information related to this profile draw upon the "Environmental Sustainability and Energy Efficiency for Architecture" II Level Master's degree course (= advanced university studies under the Italian law) from the University of Camerino: https://saad.unicam.it/it/formazione/master/ecosostenibilit%C3%A0-ed-efficienza-energetica-l%E2%80%99architettura

6.1	Identify the services, methodologies (BIM) and people to constitute an operational team		8	
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**		**8**	
7.1	Master the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.		-	
7.2	Learner is able to design and create models based on BIM software from an architectural point of view and to make energy analysis		8	
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains.**		-	
8.1	Understand how to drastically reduce the losses of buildings. (sounds like a complex problem-but not sure)		-	

[DONE]

<u>Learning programmes/courses related to the topic for the ARCH profile</u>

Title: "Environmental Sustainability and Energy Efficiency for Architecture"

Organization in charge: University of Camerino
Duration: 1 academic year (1500 h including 475 hours of traineeship)
ECTS: 60
Typology: II level master's degree course (= advanced postgraduate course associated to EQF 8)

Website (ITA): https://saad.unicam.it/it/formazione/master/ecosostenibilit%C3%A0-ed-efficienza-energetica-l%E2%80%99architettura

Presentation of the course

The Master's course focuses on issues related to environmental design in a comprehensive view of the processes of transformation, design, rehabilitation and redevelopment of buildings and urban areas, and of the construction, technological, plant and energy systems of buildings throughout their life cycle.

Learning Outcomes

The professional figure to be trained will have specific competences in the field of innovative strategies for the design of "nearly zero" energy buildings, the dissemination of renewable energies and their integration in the urban environment and built space. He/she will be able to perform energy audits of buildings, plan and design interventions aimed at improving energy performance, monitor and efficiently manage energy resources in the public and private sector, issue energy certificates. He/she will also be able to dimension and design plants for the production of energy from renewable sources. They will be able to be part of working groups for the development of research projects in the field.

Furthermore, with the master's degree he/she will acquire specific competences on BIM design, in particular he/she will be able to design and create models using softwares that use BIM technology from an architectural point of view and draw up the relevant energy analyses.

Additional Learning programmes/trainings related to the topic for the ARCH profiles:

Title: "Bioarchitecture – Casaclima environmental friendly constructions and energy certification" – Academic year 2021-2022

Organizations in charge: LUMSA University – Master School + Casaclima/Klimahouse Agency (regional energy agency and national certification body for sustainable skills in building design and construction)
Duration: 1 academic year --
ECTS: 49 including lectures, project work and traineeship
Typology: II level master's degree course (= advanced postgraduate course associated to EQF 8)
Website (ITA): https://www.agenziacasaclima.it/smartedit/documents/_mediacenter/master-21_22.pdf

Presentation of the course
The advanced course aims to deep, in the framework of urban sustainability, topics related to the design, design consultancy, energy and environmental assessment and certification for both single buildings and building stocks. The course deals with three thematic areas in a bio architecture and climate engineering perspective which are related to:
Construction techniques;
Materials and technologies;
Design

Professional profile
The course aims at training professionals providing specific executive skills in construction, urbanism and landscape and enabling them to manage urban and ecological development processes.

University Diploma issued: II Level Master's degree course in "CasaClima-Bioarchitecture: Energy-environmental certification and consultancy".

Eligibility requirements
Master's degree in scientific fields, mainly Architecture and Civil Engineering.

Programme of the course
Using a multidisciplinary approach focused on the 3 macro-areas of "Construction technique", "Materials and technologies" and "Design", the course will mainly focus on:
Sustainable development
Urban transformations
Environmental regulations
Environment, cultural and architectural heritage safeguard

Bioclimatics, natural cooling and ventilation
Building thermal and acoustic insulation
Thermal-technical systems
Ecological assessment of construction materials (mainly wood and bricks)
Solar-thermal, photovoltaic systems, heat pumps
Air conditioning
Energy renovation
Thermography, Blower Door Test, moisture and CO2
Construction and urban parameters
Energy behaviour in buildings
Energy refurbishment of existing buildings
Water management, recovery and phyto-depuration
BIM design and control aspects of a construction site
Minimum Environmental Criteria (CAM)

Table 4. European EE learning outcome matrix for building service design roles i.e. HVAC and energy design and coordinator (HVAC), assistant designer

No	Table 4: Country specific learning outcome and qualifications	EQF Level	
Building services design roles HVAC and energy design *(HVAC+E)* and Energy coordinator (HVAC), assistant designer *(ASS)*		*HVAC +E*	*ASS*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**7**	
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	
1.2	Know the health and economic issues related to good IAQ.	-	
1.3	Know the principles of safety, reliability, energy efficiency and environmental impact underlying the management of the systems	7	
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**		
2.1	Know the regulations regarding IAQ and ventilation in buildings.	7	
2.2	Know the rules for the design, sizing and implementation of a residential, tertiary or industrial ventilation system.	7	
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	7	
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**7**	
3.1	Know the keys to a successful ventilation and IAQ audit.	7	

LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**		
4.1	Know the principles of measurement, methods of analysis, measurement protocols and sampling methods.	-	
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	-	
5.1	Find avenues for improving IAQ.	-	
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**		
6.1	Know the methods of managing indoor air quality and the methods for calculating thermal loads	7	
6.2	Provide documentation on the project by means of calculation reports and graphics (plans, sections, functional diagrams, etc.).	7	

Learning programmes/courses related to the topic for the HVAC+E profile:

Design of HVAC Systems

Organization in charge: Polytechnic University of Turin
Duration: 45 h lectures + 35 h training + 20 h tutoring
ECTS: 8
Typology: Single course, part of the Master's degree in Energy and Nuclear Engineering
Website (ITA/ENG): https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01TWHND&p_a_acc=2021&p_header=S&p_lang=IT

Brief Presentation

The course, which is part of the "Design and Management of Energy Plants" curriculum, aims at providing the principles and techniques required to develop the design of HVAC system serving a residential, tertiary or industrial building, and of its components. The course is oriented towards practical applications and includes a design exercise concerning the HVAC system of a tertiary building.

Learning Outcomes

At the end of the semester, students will have acquired the knowledge and skills necessary to:
know the design data of air-conditioning systems, the methods for calculating thermal loads (with applicable regulatory references), the construction and performance characteristics of the main components and plant systems used in air-conditioning, the principles of safety, reliability, energy efficiency and environmental impact underlying the management of the systems;
identify the types of system suitable for the various applications and define their operating and control logics;
size or select the main components and subsystems of the plant;

document the project by means of calculation reports and graphics (plans, sections, functional diagrams, etc.).

Programme

The course includes 39 hours of theory lectures, 15 hours of calculation exercises, in which the quantitative aspects of plant design are illustrated, and 15 hours of exercises aimed at presenting and checking the progress of the project. In-depth seminars are also planned with the participation of sector professionals and educational visits to civil or industrial systems that represent the state of the art from the point of view of the type and technical solutions adopted, for a total of 12 hours. The students, generally in groups of 2-3 people, carry out a design exercise on the air-conditioning systems of a tertiary building. The exercise involves the identification of the design data, the choice of the type of system, the sizing of the fluid distribution networks, the choice of the main system components and the development of the functional diagram. The final paper contains the calculation report and the graphic representation of the system (scaled plans and sections, functional scheme).

Table 5. European wide BIM EE learning outcome matrix for Construction work roles i.e. Site manager, Construction site workers and installers

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
	Construction work roles Site manager (SM), Construction site workers and installers (CW)	SM	CW[5]
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**		**3**
1.1	Acquire the basics of efficient rehabilitation.		3
1.6	Explain the main contents and apply relevant parts of national energy guidelines.		3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**		
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.		
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.		
2.3	Understand the benefits of effective rehabilitation and its opportunities for professionals.		

[5] The Los and/or the associated EQF levels draw upon the Regional Qualification Framework of the Autonomous Province of Trento for the profile of "Hydro-thermal installer": https://certificazionecompetenze.provincia.tn.it/repertorioProfili/ricercaProfilo/46/dettaglio

2.4	Understanding and application of new working methods, regulations and outlooks on effective rehabilitation.		
LO3	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**		
3.1	Explain the importance efficient rehabilitation and low consumption level.		
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**		
4.1	Know the principles of measurement, methods of analysis of heat low from buildings. (LO6?)		
4.2	Know the principles of organization of spaces, ventilation, air tightness and humidity management. (LO6?)		
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**		
5.1	Know the principles of wall insulation, thermal bridges and thermal comfort.		
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**		
6.1	Know the principles of heating and domestic hot water and lighting and electrical equipment specifically in old houses.		
6.2	Testing thermo-hydraulic systems in accordance with efficiency and safety standards		**3**

Table 5. European BIM EE learning outcome matrix for Maintenance work roles i.e. Maintenance operator, Property manager, Care taker

No	Table 6: Country specific learning outcome and qualifications	,EQF Level		
Maintenance work roles Maintenance operator *(MO)*, Property manager *(PM)*, Care taker *(CT)*		*MO*	*PM*[6]	*CT*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**		**4**	
1.1	Knowing how to identify the needs and challenges of the co-ownership in terms of renovation.		-	
1.2	Acquire the basics of renovation and energy performance.		4	
1.3	Know the different stages of a renovation project.		4	

[6] The Los and the associated EQF levels draw upon the Regional Qualification Framework of Liguria with respect to the profile of “Eco-friendly condominium administrator”: https://professionipub.regione.liguria.it/docs/pdf/FP_31-012_03112021_1428.pdf

LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**		**4**	
2.1	Evaluate the potential of the co-ownership and be able to unite around the issue of renovation.		4	
2.2	To be able to collect the data necessary for the good start of the project and to know how to use an audit.		4	
2.3	Understand the different roles of each: Syndic, union council, AMO, …		4	
2.4	Know how to order a quality project management		4	
2.5	Basic knowledge on conflict management		4	
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**			
3.1	Know the different types of financing (i.e. public incentives) and be able to express yourself on this subject.		4	
3.2	Be able to collect different documentation aiming at requiring financing and incentives		4	
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**		**4**	
4.1	Know how to mobilize before the general assembly.		4	
4.2	Know the procedure to follow for a calm and legally unchallengeable vote on the work.		-	
4.3	To be able to follow the work: understand the role of each person and ensure the proper conduct of the site.		4	
4.4	Inform and raise awareness among the tenants and the owners on the range of technical, economic and managing opportunities for an energy efficient renovation of the concerned building		4	

11.4.2 France – R2M

The following changes of the tables refer to the second phase. Six new programs were identified and associated them with the 6 Tables (one for each). In terms of method (following the first version), there was a mapping of specific training programs (identified recently or those in earlier tasks) based on their link to the target audience of each table. In these tables learning outcomes are given an approximate EQF level based on the educational goals listed for each training/module.
For the third phase, some of the future actions involve activities with DTTN, which are describd in the previous section.

	Training	Organisation	Duration	Audience	Link
1.1	**MSc Engineers for Smart Cities**	University of Côte d'Azur, IMREDD – Capenergies – Enedis – RTE – EDF – GRDF – CEA	40 hours – 3.5 ECTS module	All but primarily audiences of Table 1	Energy module

		- CCI 06 - Club Smart grids - Dalkia Smart Building	within 1 year program		

No	Table 1: Country specific learning outcome and qualitfications	EQF LEVEL			
Client & Client advisors Client & Project manager (C), Energy manager (EM), Energy coordinator (BC), briefing consultant (Bc)		C	EM	EC	Bc
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**4**	**5**	**5**	**5**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	5	5	4
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	2	3	3	3
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	3	3	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**6**	**6**	**6**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	2	3	2	2
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	2	4	4	2
2.3	Explain relations between life-cycle costs, energy performance and building performance.	2	3	3	2
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**2**	**3**	**3**	**2**
3.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	2	3	3	2
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**2**	**2**	**2**	**2**
4.1	Learner is able to use relevant energy target-setting tools.	2	2	2	2
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**2**	**3**	**3**	**2**
5.1	Learner is able to explain and use energy production/consumption methods.	3	4	4	3
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**	**2**	**2**
6.1	Learner is able to use tools such as energy management software.	2	2	2	2

	Training	Organisation	Duration	Audience	Link
1.2	**Boiler room optimisation : design – regulation - management**	MOOC – University of La Rochelle – TIPEE platform – PACT – ADEME – New Acquittance region – City of Périgny – CDA La Rochelle – ULR Technical Service – City of La Rochelle – ITF – Atmosphere – Caléfacto – Laurent Gouet Energy – FT2E – Thermal Hervé – Missenard Quint – INTIS – IBS – IISB – Axima – Dalkia – Idex	5 weeks	Audiences of Table 1 and Technicians and engineers in thermal design office, Climate engineering business managers, responsible for technical and energy services in local authorities, Public and private building fleet managers, Energy managers (in charge of new and renovation projects), Control offices, Technicians from climatic engineering installations or operations, Integrators, Energy advisors	Boiler room optimisation : design – regulation - management

No	Table 1: Country specific learning outcome and qualitfications	EQF LEVEL			
	Client & Client advisors Client & Project manager (C), Energy manager (EM), Energy coordinator (BC), briefing consultant (Bc)	~~C~~	~~EM~~	~~EC~~	~~Bc~~
~~LO1~~	**Learner is able to understand a block diagram and the control points of a boiler room**	~~6~~	~~6~~	~~6~~	~~6~~
~~1.1~~	Learner is able to Analyse and simplify the design of a boiler room	~~6~~	~~5~~	~~5~~	~~5~~
~~1.2~~	Learner is able to understand the constraints of different multi-energy block diagrams	~~5~~	~~5~~	~~5~~	~~5~~
~~1.3~~	Learner will master the regulation of heating installations	4	~~5~~	~~5~~	4
~~1.4~~	Learner is able to use technical building management as a tool for optimizing facility performance	4	4	4	4

	Training	Organisation	Duration	Audience	Link
2.1	**Passive and low-carbon building: the global approach through BIM**	The Passive House – Oelys – PACT - ADEME	6 weeks	Audiences of Table 2	Passive and low-carbon building

No	Table 2: Country specific learning outcome and qualitfications	EQF LEVEL		
	Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)	CD	ARCH	ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	6	6	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	6	6	5
1.3	Summarize the ideas of digital space and asset management.	6	6	6
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**5**	**5**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	6	5	5
2.2	Distinguish the level of passive performance	6	6	6
2.3	Understand and know the 4 performance criteria	6	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**4**
3.1	Learner is able to understand and describe how to capitalize on passive energy gains.	5	5	4
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**4**	**4**	**3**
4.1	Learner is able to use relevant energy target-setting tools.	4	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**6**	**6**	**5**
5.1	Learner is able to explain and use energy production/consumption methods.	6	5	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**6**	**6**	**6**
6.1	Identify the services, methodologies (BIM) and people to constitute an operational team	6	6	6

LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**6**	**6**	**6**
7.1	Master the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.	6	6	6
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains.**	3	3	2
8.1	Understand how to drastically reduce the losses of buildings.	6	5	5

	Training	Organisation	Duration	Audience	Link
2.2	**RE2020: Prepare for the new environmental regulations**	MOOC – TIPEE – CSTB – Ministry of Ecological Transition – Artielia Sustainable Buildings – TRIBU ENERGIE – ADEME: Ecological Transition Agency – Department of Housing, Town Planning and Landscape	4 weeks	Audiences of Table 2 and Real state professionals, Construction economists, Teachers and trainers	RE2020

No	Table 2: Country specific learning outcome and qualitfications	EQF LEVEL		
	Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)	CD	ARCH	ASS
LO1	Learner is able to situate the context and challenges of RE2020	6	6	6
1.1	Learner understands the new regulations according to the 3 axes: energy, carbon and summer comfort	6	6	5
1.2	Learner knows the different roles at each phase of the project	6	6	5
1.3	Learner is able to make choices as an MOA	6	6	6
1.4	Learner is able to find the right information	6	6	6

	Training	Organisation	Duration	Audience	Link
3.1	**DigiBTP – MOOC BIM and EnR, perspectives**	Sup'EnR – INSA Toulouse – SECA, University of Perpignan Via Domitia – Miro Program, University of	5 short self-paced modules (each session up to an hour)	Table 3	MOOC BIM

		Perpignan Via Domitia - DIRECCTE			

No	Table 3: Country specific learning outcome and qualitfications	EQF Level	
	Structural design roles Structural design (SD) and coordinator (structural), Assistant designer (ASS)	~~C~~ SD	~~EM~~ ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**
1.1	Learner is able to understand the interest of integrating renewable energies into BIM (Building Information Modeling) models.	7	6
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**7**	**6**
2.1	Learner is able to understand the impact of RE in BIM models.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**6**	**5**
3.1	Learner will be able to be a player in the evolution of BIM models towards BIM-GEM models (Management, Operation, Maintenance).	6	6
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**6**	**5**
4.1	Integration into public contracts for new buildings and renovation	6	6

	Training	Organisation	Duration	Audience	Link
3.2	**DigiBTP – MOOC BIM and EnR, perspectives**	University of Perpignan Via Domitia – BIM on O&M – Pyrées-Orientales Technological Platform – ENERGIE R BET design – Perpignan – BIM World Programs - Sup'EnR – INSA Toulouse – SFCA – Miro Program - DIRECCTE	5 modules each requiring between 10 minutes and 1 hour of work	Table 3 and Construction professionals, donors, the contractors, individuals in need of training	DigiBTP - MOOC BIM

No	Table 3: Country specific learning outcome and qualitfications	EQF Level	
Structural design roles Structural design (SD) and BIM coordinator (structural), Assistant designer (ASS)		C	EM
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**7**	**7**
1.1	Learner is able to understand the interest of integrating renewable energies into BIM (Building Information Modeling) models.	7	6
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**7**	**6**
2.1	Learner is able to understand the impact of RE in BIM models.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**6**	**6**
3.1	Learner will be able to be a player in the evolution of BIM models towards BIM-GEM models (Management, Operation, Maintenance).	6	6
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**6**	**6**
4.1	Integration into public contracts for new buildings and renovation	6	6

	Training	Organisation	Duration	Audience	Link
4.1	**Indoor Air quality: Ventilating for healthy air**	Cerema – Tipee Platform – PACT – ADEME – General Directorate of Housing and Nature Planning	5 weeks	All but primarily audiences of Table 4	Indoor Air quality

No	Table 4: Country specific learning outcome and qualitfications	EQF Level	
Building services design roles HVAC and energy design (HVAC+E) and Energy coordinator (HVAC), assistant designer (ASS)		HVAC +E	ASS

LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	7
1.2	Know the health and economic issues related to good IAQ.	7	7
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**
2.1	Know the regulations regarding IAQ and ventilation in buildings.	6	6
2.2	Know the rules for the design, sizing and implementation of a residential ventilation system.	6	6
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**4**	**3**
3.1	Know the keys to a successful ventilation and IAQ audit.	5	5
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**3**	**3**
4.1	Know the principles of measurement, methods of analysis, measurement protocols and sampling methods.	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**3**	**2**
5.1	Find avenues for improving IAQ.	5	4
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**
6.1	Know the methods of managing indoor air quality.	5	5

	Training	Organisation	Duration	Audience	Link
4.2	**Indoor Air quality: Ventilating for healthy air Service sector**	Cerema – Tipee – CETIAT – Eurovent - CD33 – ALLIE'AIR – AQC – GREEASE – UNICLIMA – LINDAB – AICVF – APAVE – PBC - PACTS – ADEME – General Directorate of Housing and Nature Planning	5 weeks	All but primarily audiences of Table 4	Indoor Air quality – Service sector

No	Table 4: Country specific learning outcome and qualitfications	EQF Level	
	Building services design roles HVAC and energy design (HVAC+E) and Energy coordinator (HVAC), assistant designer (ASS)	HVAC +E	ASS
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	7
1.2	Know the health and economic issues related to good IAQ.	7	7
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**
2.1	Know the regulations regarding IAQ and ventilation in buildings.	6	6
2.2	Know the rules for the design, sizing and implementation of a residential ventilation system.	6	6
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**
3.1	Know the keys to a successful ventilation and IAQ audit.	5	5
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**4**	**4**
4.1	Know the principles of measurement, methods of analysis, measurement protocols and sampling methods.	4	4
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**5**	**4**
5.1	Find avenues for improving IAQ.	5	3
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**4**	**4**
6.1	Know the methods of managing indoor air quality	5	5

	Training	Organisation	Duration	Audience	Link
5.1	**SPOC Efficient renovation – the keys to energy rehabilitation**	ASDER – Arcane –	6 weeks	Audiences of Table 5	Keys to energy rehabili-tation

No	Table 5: Country specific learning outcome and qualitfications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**4**
1.1	Acquire the basics of efficient rehabilitation.	6	6
1.2	Know the keys to renovating an existing building at low consumption level.	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**4**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	5

	Training	Organisation	Duration	Audience	Link
5.2	**Efficient renovation – the keys to energy rehabilitation**	ASDER – Arcane – CCCA-BTP – Cluster Eco Bâtiment Auvergne-Rhône-Alpes – The CLER – Constructys – Effinergie – Burgundy-Franche-Comté Energy Pole – PACT – ADEME – Auvergne Rhône Alpes Region – Normandy Region	6 weeks	Audiences of Table 5	Efficient renovation

No	Table 5: Country specific learning outcome and qualitfications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Acquire the basics of efficient rehabilitation.	6	6

1.2	Know the keys to renovating an existing building at low consumption level.	6	5
1.3	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	5	4
1.4	Explain added value of sustainable energy efficient practices and sustainable projects.	4	4
1.5	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**3**	**2**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	4
2.3	Understand the benefits of effective rehabilitation and its opportunities for professionals.	5	5
2.4	Understanding and application of new working methods, regulations and outlooks on effective rehabilitation.	4	4
LO3	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**4**
3.1	Explain the importance efficient rehabilitation and low consumption level.	**5**	**5**
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**
4.1	Know the principles of measurement, methods of analysis of heat low from buildings.	**5**	**5**
4.2	Know the principles of organization of spaces, ventilation, air tightness and humidity management.	**5**	**5**
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**	**5**	**5**
5.1	Know the principles of wall insulation, thermal bridges and thermal comfort.	**5**	**5**
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**4**	**4**
6.1	Know the principles of heating and domestic hot water and lighting and electrical equipment specifically in old houses.	**4**	**4**

	Training	Organisation	Duration	Audience	Link
5.3	**Efficient renovation – risks and good reflexes**	AQC - ASDER – CD2E – Ekopolis – Collectif Effinergie – CSTB – BE Enertech – Arcanne – Enérgelio – Coux Frères company – Walterre – BE CENA engineering – Coopilote – Atelier du Vieux Bourg – Synéo –	5 weeks	Audiences of Table 5	Energy renovation – risks and good reflexes

		ADEME – CAPEB – FFB – USH – UNSFA – CINOV			

No	Table 5: Country specific learning outcome and qualitfications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Identify the risks associated with efficient renovation**	**6**	**6**
1.1	Diagnose a situation, knowing the risks associated with interfaces and mastering the right actions.	6	6
1.2	Understand the importance of good coordination to allow quality work	6	6
LO2	**Objectives concerning the Joinery sequence**		
2.1	Learner knows how to assess the condition of an existing window	6	6
2.2	Learner knows how to integrate a rolling shutter without risk of thermal bridging / infiltration	6	6
2.3	Learner is able to manage the link between joinery and interior or exterior insulation	6	6
2.4	Learner knows how to safely install a window during renovation	6	6
LO3	**Objectives concerning the Floor / Roof sequence**		
3.1	Learner knows how to assess the condition of an existing roof	6	6
3.2	Learner knows the risks when insulating attic, crawling or roof terrace	6	6
3.3	Learner is able to manage the interface with the insulation of the walls	6	6
3.4	Learner knows how to insulate low floors without risk	6	6
3.5	Learner is able to manage the thermal bridge (s) of the floor slabs	6	6
LO4	**Objectives concerning the Walls sequence**		
4.1	Learner is able to evaluate the relevance of an ITE or an ITI and know the main risks	6	6
4.2	Learner knows how to combine interior insulation with exterior insulation in the event of renovation with complex geometry	6	6
4.3	Learner knows how to properly implement insulation from the inside while limiting the risks associated with humidity	6	6
LO5	**Objectives concerning the sequence: Ventilation**		
5.1	Learner knows the risks and good practices related to the installation of a CMV in the home	6	6
5.2	Learner understands the key role of ventilation in high-performance buildings	6	6
5.3	Learner knows how to install a single flow ventilation system without risk	6	6
LO6	**Objectives concerning the sequence: Heating**		
6.1	Learner knows how to size a heating system to limit the risk of overconsumption	6	6

6.2	Learner knows how to react in the event of a change in the heating mode not concomitant with the thermal improvement work of the envelope	6	6
6.3	Learner knows how to maintain and optimize the performance of a boiler room	6	6
LO7	**Objectives concerning the DHW / PV / air conditioning sequence**		
7.1	Learner knows the risks and good practices when changing the domestic hot water production system	6	6
7.2	Learner knows the risks and good practices when installing photovoltaic panels	6	6
7.3	Learner knows the risks and good practices when installing / renovating air conditioning	6	6

	Training	Organisation	Duration	Audience	Link
6.1	**MOOC Réno Copro – The keys to energy rehabilitation**	ADEME – ALEC Gronoble – FLAME - The CLER – UNITED - Order of Architects - Pouget Consultants - EEC	4 weeks	All but primarily audiences of Table 6	MOOC Reno Corpo

No	Table 6: Country specific learning outcome and qualitfications			
Maintenance work roles Maintenance operator (MO), Property manager (PM), Care taker (CT)		MO	PM	CT
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Knowing how to identify the needs and challenges of the co-ownership in terms of renovation.	6	6	5
1.2	Acquire the basics of renovation and energy performance.	6	6	5
1.3	Know the different stages of a renovation project.	6	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**	**6**
2.1	Evaluate the potential of the co-ownership and be able to unite around the issue of renovation.	5	4	4
2.2	To be able to collect the data necessary for the good start of the project and to know how to use an audit.	5	5	4
2.3	Understand the different roles of each: Syndic, union council, AMO, ...	6	6	5
2.4	Know how to order a quality project management.	6	6	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**5**

3.1	Know the different types of financing and be able to express yourself on this subject.	5	5	4
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**	**5**
4.1	Know how to mobilize before the general assembly.	5	5	5
4.2	Know the procedure to follow for a calm and legally unchallengeable vote on the work.	5	5	4
4.3	To be able to follow the work: understand the role of each person and ensure the proper conduct of the site.	5	5	4

	Training	Organisation	Duration	Audience	Link
6.2	**MOOC Adaptation of buildings to climate change**	Sustainable Real Estate Observatory – WILD TREES – Sustainable Building Plan – ADEME – ONERC (National Observatory of the Effects of Global Warming) – Ministry of Ecological Transition – City of Paris – ADI (Association of Real Estate Directors)	5 weeks	Audiences of Table 6 and public or private contractors, developers, investors, landlords, building users, members of professional organisations – academics and students	MOOC Adaptation of buildings to climate change

No	Table 6: Country specific learning outcome and qualitfications			
~~**Maintenance work roles**~~ ~~Maintenance operator (MO), Property manager (PM), Care taker (CT)~~		~~MO~~	~~PM~~	~~CT~~
~~**LO1**~~	~~**Aims to develop the skills of real estate players in terms of adaptation to climate change, as well as the identification of the main levers available to achieve this**~~	~~**6**~~	~~**7**~~	~~**6**~~
~~1.1~~	~~Learner gains knowledge on the subject of climate change (scientific and regulatory framework, causes, inventory, consequences) and decipher the direct and indirect impacts of climate change on buildings and on the real estate sector~~	~~7~~	~~7~~	~~7~~
~~1.2~~	~~Learner is presented with methodological elements for the assessment of the vulnerability of a building and the awareness of the various stakeholders~~	~~7~~	~~7~~	~~7~~

~~1.3~~	~~Learner is able to identify and prioritize the options for adaptive actions, provide sources of information and present an overview of the main actors involved~~	~~6~~	~~7~~	~~6~~
~~1.4~~	~~Learner will get to know the actors of climate change adaptation and the tools and sources of inspiration available to all~~	~~6~~	~~6~~	~~6~~
~~1.5~~	~~Learner will learn about how to adopt a vision of adaptation to climate change integrated into a reflection on more global risks~~	~~6~~	~~6~~	~~6~~

No	Example Table X: Learning outcomes	EQF level			
Client & Client advisors Client & Project manager (C), Energy manager (EM), Energy coordinator (EC), briefing consultant (Bc)		C	EM	EC	Bc
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**4**	**6**	**6**	**4**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	6	5	4
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	4	6	5	5
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	2	3	3	5
1.4	Summarize the ideas of digital space and asset management.	6	3	3	5
1.5	Explain the added value of using energy model open file formats to ensure interoperability.	3	5	5	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	4	6	5	-
LO2	**Learner is able to explain the fundamentals of sustainable and energy-efficient buildings and building performance.**	**3**	**3**	**3**	**5**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	4	4	4	3
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	5	4	4	3
2.3	Explain relations between life-cycle costs, energy performance and building performance.	3	3	3	5
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	3	2	2	5
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	3	3	3	5
LO3	**Learner is able to prepare energy management execution plan and explain essential aspects in setting energy strategic and project targets.**	**6**	**6**	**4**	**6**

3.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	6	4	3	6
3.2					
3.3					
3.4					
...	...				
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**				
4.1					
4.2					
4.3					
...	...				
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**				
5.1					
5.2					
5.3					
...	...				
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**				
6.1					
6.2					
6.3					
...	...				
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**				
7.1					
7.2					
7.3					
....	...				
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**				
8.1					
8.2					
8.3					
....	...				

11.5 East Europe

11.5.1 EnEffect – Bulgaria

The following changes of the tables refer to the second phase, based on recent work on BUS League for the framework on continuous professional development. For the third phase, no changes are foreseen, at that moment. Inputs on circular skills generated by a new project could give first results, which could be expected in February 2022.

Table 1: European EE learning outcome matrix for Client & Client advisors i.e. Client & Project manager, manager, coordinator, briefing consultant.

No	Table 1: Country specific learning outcome and qualifications	EQF LEVEL			
Client & Client advisors Client & Project manager *(C),* Energy manager *(EM),* Energy coordinator *(BC),* briefing consultant *(Bc)*		*C*	*EM*	*EC*	*Bc*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**4**	**5**	**5**	**5**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	5	5	4
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	2	3	3	3
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	3	3	3
1.4	Learner is able to identify factors that can positively influence the economic and energy efficiency of a building.	4	4	4	4
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**6**	**6**	**6**
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	2	3	2	2
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	2	4	4	2
2.3	Explain relations between life-cycle costs, energy performance and building performance.	2	3	3	2
2.4	Explain the importance of achieving adequate levels of ventilation, lighting, acoustic and thermal comfort	3	3	3	3
2.5	Understanding the importance of eliminating thermal bridges in buildings.	3	3	3	3
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**2**	**2**	**2**	**2**

3.1	Learner is able to use relevant energy target-setting tools.	2	2	2	2
3.2	Ability to explain and use the key economic parameters: payback period, net present value, etc.	4	4	4	4
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**2**	**3**	**3**	**2**
4.1	Explain the importance and illustrate processes of collecting energy targets for buildings, indoor environments and energy performance.	2	3	3	2
4.2	Learner is able to interpret correctly the legal framework for energy efficiency in buildings and also nZEBs.	4	4	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**2**	**3**	**3**	**2**
5.1	Learner is able to explain and use energy production/consumption methods.	3	4	4	3
5.2	Learner is able to explain the difference between investment cost and energy saving cost.	4	4	4	3
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**	**2**	**2**
6.1	Learner is able to use tools such as energy management software.	2	2	2	2
6.2	Learner is able to identify the specialties involved in the energy management procedures and provide quality assurance methods for these procedures.	5	4	4	3

Table 6: European EE learning outcome matrix for Architectural design roles i.e. Architectural design and Coordinator (arch), Chief designer (CD), Architect (ARCH), Assistant designer (ASS)

No	Table 2: Country specific learning outcome and qualifications	EQF LEVEL		
Architectural design roles Architectural design and Energy Coordinator (arch), Chief designer *(CD),* Architect *(ARCH),* Assistant designer *(ASS)*		*CD*	*ARCH*	*ASS*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	6	6	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	6	6	5
1.3	Summarize the ideas of digital space and asset management.	6	6	6
1.4	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	6	6	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**5**	**5**

2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	6	5	5
2.2	Distinguish the level of passive performance	6	6	6
2.3	Understand and know the 4 performance criteria	6	6	6
2.4	Summarise and illustrate the potentials of renewable energy sources including district-scale systems.	4	4	3
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**4**
3.1	Learner is able to understand and describe how to capitalize on passive energy gains.	5	5	4
3.2	Ability to explain and use the key economic parameters: payback period, net present value, etc.	4	4	3
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**4**	**4**	**3**
4.1	Learner is able to use relevant energy target-setting tools.	4	4	3
4.2	Understanding and ability to explain the role and importance of integrating different RES installations.	4	4	3
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**6**	**6**	**5**
5.1	Learner is able to explain and use energy production/consumption methods.	6	5	5
5.2	Ability to perform energy analyses including dynamic simulations.	6	6	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**6**	**6**	**6**
6.1	Identify the services, methodologies (BIM) and people to constitute an operational team	6	6	6
6.2	Ability to work collaboratively with all project stakeholders: design team, clients, users, manufacturers, workers and building authorities.	6	6	6
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	**6**	**6**	**6**
7.1	Master the technical principles (insulation, thermal bridges, airtightness, heat recovery) within the relevant software.	6	6	6
7.2	Validate and check compatibility of the energy model and also manage and eliminate conflicts.	6	6	6
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains.**	3	3	2
8.1	Understand how to drastically reduce the losses of buildings.	6	5	5
8.2	Presenting technical solutions for eliminating thermal bridges in buildings.	6	6	5

Table 3 European wide EE learning outcome matrix for structural design roles i.e. Structural design and coordinator (structural), Assistant designer

No	Table 3: Country specific learning outcome and qualifications	EQF Level		
Structural design roles Structural engineering design Magister *(SED), Construction Management* (Bachelor), *Project Management in Construction (Master)*		*SED*	*CM*	*PMC*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	-	-	-
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	4	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	3	4	5
1.3	Summarize the ideas of digital space and asset management.	2	2	2
1.4	Explain the added value of using energy model open file formats to ensure interoperability.	2	2	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3	4
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	-	-	-
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	4	5	6
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	4	5	6
2.3	Explain relations between life-cycle costs, energy performance and building performance.	5	5	6
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	4	4	5
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	3	3	4
2.6	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	4	5
2.7	List and explain indoor comfort criteria	3	4	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	-	-	-
3.1	Explain the overall design process for energy-efficient building.	3	4	5
3.2	Assist client to set realistic and achievable energy and building performance target.	3	4	5
3.3	Perform preliminary energy analysis in the early project stages for both new and renovation projects to add value for the decision making.	4	4	5
3.4	Assist the client to set and specify information requirements.	4	4	5

3.5	Explain how to support owner's effective decision-making and opinion formation of other stakeholders.	4	4	5
3.6	Illustrate how to direct the design towards set targets utilizing the capacity of different kinds of assessment methods relevant for building construction design.	5	5	6
3.7	Explain the flow of design teamwork and demonstrate how to prepare, compare and improve alternative concepts.	5	5	6
3.8	Lead / assist the tasks related to technical documents for the building authorities.	6	5	6
3.9	Describe different solutions for improving the energy efficiency in buildings	4	4	5
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	-	-	-
4.1	Apply the set performance targets related to building design into BIM-based design process.	4	4	4
4.2	Iterate the design solutions to meet the set targets of building performance and energy efficiency.	4	4	4
4.3	Consider options of renewable energy and optimize its potentials.	3	3	4
4.4	Create different energy efficient design concepts renewable energy systems.	3	4	4
4.5	Perform energy analyses including dynamic simulations.	2	2	2
4.6	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2	2	2
4.7	Perform lightning calculations, analyses and simulations.	2	2	2
4.8	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4	5	5
4.9	Use life cycle cost calculation including life-cycle studies changing influential design parameters.	5	4	5
4.10	Share the results of energy simulations, discuss the options and update domain BIMs.	4	3	4
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	-	-	-
5.1	Prepare the Construction engineer's domain model on the basis of set targets and definitions given in architect's domain model.	6	3	4
5.2	Create and update digital (BIM-linked) building specification with material and dimensional information to reflect owner's quality and performance requirements.	4	3	4
5.3	Explain essential issues of the needs of initial information and the potentials of different inventory surveys in refurbishment projects.	5	4	5
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4

5.5	Prepare/assist information needed for specific use cases such as bill of quantities.	6	5	6
5.6	Prepare/assist the domain model for simulation and assessment.	5	4	5
5.7	Prepare/assist models and information for planning authority and in required data format.	4	3	4
5.8	Prepare/assist models and information for procurement and construction.	5	4	5
5.9	Prepare models to fulfil quality and information requirements for quality control and assurance processes in construction.	5	4	5
5.10	Prepare models based on data and information requirements of sustainable care and maintenance processes.	4	4	5
5.11	Prepare information for As-Built Models and Maintenance model for utilization of client and building management.	4	4	5
5.12	Prepare/assist in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performance requirements.	5	4	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	-	-	-
6.1	Describe the essential parts of the procedure for BIM based collaboration.	4	4	5
6.2	Describe different collaborative interdisciplinary and open BIM working methods, tools and processes.	4	4	5
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	4	4	5
6.4	Prepare relevant visualization models to enable information sharing, decision making and opinion formation.	5	4	5
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	6	5	6
6.6	Collaborate with the help of communication platforms and processes.	6	5	6
6.7	Clarify and delegate specific responsibilities in the execution of works	4	4	5
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**	-	-	-
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	4	3	4
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	4	3	4
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	5	3	4
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	5	4	5

7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	4	3	4
7.6	Instruct and audit contractors on construction site on critical points.	6	4	5
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	4	3	4
7.8	Describe and assess the quality assurance procedures according to the stages of assembly of building elements and systems.	4	4	5
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**	-	-	-
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	6	4	4
8.2	Use relevant energy design calculations and assessment tools in different design phases.	2	3	3
8.3	Use different tools for BIM-based collaborative working.	5	4	5
8.4	Create combination model and use model checking tools for clash detection.	4	3	4
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	3	3	4
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	5	3	4
8.7	Prepare the domain model for simulation and assessments	4	3	4
8.8	Use tools for environmental impact analyses.	3	3	4
8.9	Use project data and file management systems.	5	4	5

Table 7 European EE learning outcome matrix for building service design roles i.e. HVAC and energy design and BIM coordinator (HVAC), assistant designer

No	Table 4: Country specific learning outcome and qualifications	EQF Level	
Building services design roles HVAC and energy design *(HVAC+E)* and Energy coordinator (HVAC), assistant designer *(ASS)*		*HVAC +E*	*ASS*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Know the sources of indoor pollutants, ventilation systems and air treatment.	7	7

1.2	Know the health and economic issues related to good IAQ.	7	7
1.3	Knowledge of different situations when ventilation airflow can be limited/increased	6	6
1.4	Knowledge of the factors that influence a ventilation system	6	6
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**
2.1	Know the regulations regarding IAQ and ventilation in buildings.	6	6
2.2	Know the rules for the design, sizing and implementation of a residential ventilation system.	6	6
2.3	Recognize the pathologies and implementation faults and know how to apprehend their impacts.	6	6
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**4**	**3**
3.1	Know the keys to a successful ventilation and IAQ audit.	5	5
3.2	Knowledge of all factors influencing the thermal comfort in buildings.	6	6
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**3**	**3**
4.1	Know the principles of measurement, methods of analysis, measurement protocols and sampling methods.	4	3
4.2	Knowledge of active and passive methods for utilization of renewable energy sources.	5	5
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**	**3**	**2**
5.1	Find avenues for improving IAQ.	5	4
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**2**	**2**
6.1	Know the methods of managing indoor air quality.	5	5
6.2	Learner is able to use different approaches and features in creating models of energy consumption of buildings for the heating and cooling periods.	7	6

Table 5 European wide EE learning outcome matrix for Construction work roles i.e. Site manager, Construction site workers and installers

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
Construction work roles Site manager *(SM)*, Construction site workers and installers *(CW)*		*SM*	*CW*

LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**4**
1.1	Acquire the basics of efficient rehabilitation.	6	6
1.2	Know the keys to renovating an existing building at low consumption level.	5	5
1.3	Ability to read working drawings, assembly plans and specifications.	5	4
1.4	Understanding the principles for achieving high thermal performance envelopes	4	3
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**5**	**4**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	5
2.3	Knowledge of the standards for thermal comfort	4	4

No	Table 5: Country specific learning outcome and qualifications	EQF Level	
Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**5**
1.1	Acquire the basics of efficient rehabilitation.	6	6
1.2	Know the keys to renovating an existing building at low consumption level.	6	5
1.3	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	5	4
1.4	Explain added value of sustainable energy efficient practices and sustainable projects.	4	4
1.5	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	2
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3
1.7	Knowledge of the basic requirements for safety, occupational health and fire protection	2	2
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**3**	**2**
2.1	Understand the importance of offering quality services, and of adjusting them to those, complementary, of other stakeholders.	5	5
2.2	Understand that there is a market to seize and record the elements that will help to find its place there.	5	4
2.3	Understand the benefits of effective rehabilitation and its opportunities for professionals.	5	5

2.4	Understanding and application of new working methods, regulations and outlooks on effective rehabilitation.	4	4
LO3	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**4**
3.1	Explain the importance efficient rehabilitation and low consumption level.	5	5
3.2	Learner is able to identify the critical features of buildings with low consumption	4	4
LO4	**Learner is able to explain the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**
4.1	Know the principles of measurement, methods of analysis of heat low from buildings.	5	5
4.2	Know the principles of organization of spaces, ventilation, air tightness and humidity management.	5	5
LO5	**Learner is able to explain and use energy-based collaboration methods for energy management and processes.**	**5**	**5**
5.1	Know the principles of wall insulation, thermal bridges and thermal comfort.	5	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**	**4**	**4**
6.1	Know the principles of heating and domestic hot water and lighting and electrical equipment specifically in old houses.	**4**	**4**
6.2	Ability to evaluate the performance of an envelope element, knowledge of the typical values and the effects they have on the thermal comfort, thermal bridges	**5**	**5**

Table 8 European EE learning outcome matrix for Maintenance work roles i.e. Maintenance operator, Property manager, Care taker

No	Table 6: Country specific learning outcome and qualifications	,EQF Level		
Maintenance work roles Maintenance operator *(MO)*, Property manager *(PM)*, Care taker *(CT)*		*MO*	*PM*	*CT*
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**	**6**	**6**	**6**
1.1	Knowing how to identify the needs and challenges of the co-ownership in terms of renovation.	6	6	5
1.2	Acquire the basics of renovation and energy performance.	6	6	5
1.3	Know the different stages of a renovation project.	6	5	5
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**	**6**	**6**	**6**
2.1	Evaluate the potential of the co-ownership and be able to unite around the issue of renovation.	5	4	4

2.2	To be able to collect the data necessary for the good start of the project and to know how to use an audit.	5	5	4
2.3	Understand the different roles of each: Syndic, union council, AMO, …	6	6	5
2.4	Know how to order a quality project management.	6	6	5
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**	**5**	**5**	**5**
3.1	Know the different types of financing and be able to express yourself on this subject.	5	5	4
3.2	Knowledge on how to interpret the energy audit and energy certificate of a building.	5	4	3
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**	**5**	**5**	**5**
4.1	Know how to mobilize before the general assembly.	5	5	5
4.2	Know the procedure to follow for a calm and legally unchallengeable vote on the work.	5	5	4
4.3	To be able to follow the work: understand the role of each person and ensure the proper conduct of the site.	5	5	4
4.4	Learner is able to identify opportunities for energy savings.	5	4	3

APPENDIX A - Academy of Healthy Construction, Poland

The Passive and Energy Efficient Buildings Master Training

Organised by: Academy of Healthy Construction, Poland

For whom: can be regarded as mandatory for all participants in the construction process, in particular: contractors, architects, civil engineers, installation designers, fitters, master builders, manufacturers, the banking sector, real estate agents and others.

Context: At the end of 2020, construction law is changing - all new buildings must be nearly zero-energy buildings. Private and institutional customers already demand experience in complex implementation of passive or low-energy buildings. The market is opening for specialized companies and their employees, which means a new source of income for many.

Upon passing the exam: International Certificate, Title

Duration: 10 weeks

Other key facts:

- a training program, during which you learn step by step how to implement, supervise, design new buildings and retrofits to the highest energy standards.
- the training is conducted by an International Trainer and Expert in Energy Efficient and Passive Building
- variety of materials - video recordings, practical examples, engaging presentations, model and proven solutions - over 800 slides and numerous exercises to perform.
- access to the Program for as many as 2 years – the participants can work through the course as many times as needed.

Material and learning outcomes:

- First week - Basics of Passive and Energy Efficient Building
    - origins and development of passive/high-energy efficient buildings;
    - passive buildings and climate change, climate neutrality and the passive standard;

- quality in highly energy efficient buildings, arguments for discussions with customers;
- differences between individual energy standards, why a passive building;
- examples of buildings with different functions in passive and highly energy-efficient standard realized and monitored.

- Second week - Energy balance
  - energy balance in passive and highly energy-efficient buildings;
  - basics and execution assumptions relevant to various technologies;
  - implementation of objects of the highest energy standards - methodology building solutions' selection.
- Third week - Forming an airtight coating
  - the economics of passive building;
  - available building solutions vs. building value and durability and the potential for construction cost savings;
  - air tightness and the energy standard of a building;
  - the essence of airtightness in terms of sick building syndrome, building damage;
  - materials for airtightness, principles for selecting and combining appropriate solutions;
  - details and correct practices in implementation, comparison of effectiveness of individual solutions;
  - examples of best practice solutions in buildings constructed using different technologies
  - the most common mistakes;
  - airtightness control system at different stages of building completion in different technologies, guidelines and procedures
  - methods and tools for the verification of the airtightness of buildings.
- Fourth week – Building construction workflow - course of execution works, supervision, coordination
  - Passive and highly energy efficient building construction workflow, stages and supervision of passive and highly energy efficient building construction, coordination between sectors, branches, key decision making.
- Fifth week – Formation of a thermally insulating coating
  - types of insulation materials and relevant comparative parameters;
  - types of external partitions, influence/impact of the chosen technology and materials applied on the use of the building;
  - examples of external partitions appropriate for buildings of the highest energy standards;
  - detailing and proper execution/implementation practices;
  - examples of most common mistakes and the rules for their elimination.
- Sixth week - Forming the shell without thermal bridges, windows
  - building envelope without thermal bridges and their impact on building energy standard;
  - building damage, building durability, sick building syndrome;
  - materials and solutions eliminating thermal bridges completely or significantly reducing them;
  - details and proper practices in execution/implementation, durability of particular solutions;
  - examples of most common mistakes and ways to eliminate them;
  - objectives and requirements for translucent coatings in buildings with the highest energy efficiency;

  - characteristics and methodology of selection of glazing type depending on the location of the building;
  - principles of installing windows in the building envelope, available materials, proven solutions;
  - details and proper practices in execution/implementation, durability of individual solutions;
  - methods and tools for evaluating the quality of work performed in the installation of windows and door frames.
- Seventh week – Supply of fresh air, heat, cooling and DHW
  - available installation systems dedicated to passive and highly energy-efficient buildings and the impact of individual solutions on their energy balance;
  - objectives and requirements for installations in buildings with the highest energy standards;
  - solutions with the highest efficiency, system components and rules of selection of individual components;
  - innovative solutions and examples of their implementation;
  - details and correct practices in execution/implementation with examples of model solutions, tight installation through the building envelope;
  - methods and tools for assessing the quality of work performed in connection with installations in passive and highly energy-efficient buildings.
- Eight week – Upgrading to the highest energy standards
  - principles of selection of insulation materials and elimination of thermal bridges depending on the technology of the modernized building;
  - ways of forming an airtight envelope in a modernized building;
  - evaluation of possibilities connected with modernization of a building to the highest standards, economic aspects.
- Ninth week – Upgrading to the highest energy standards
  - rules of ventilation system selection in modernized objects, influence on balance;
  - principles of selection of heating, cooling and hot water preparation system in a modernized building to achieve passive and highly energy efficient standards;
  - proper execution practices in modernized objects.
- Tenth week – Best practices / solutions
  - model retrofits to passive standard, stages of work, coordination, key decisions;
  - the way to passive standard in massive and wooden technology on the examples of buildings.
- The end of the training:
  - Option A: Exam and international certificate, title and logo

Certificate

Passive House Tradesperson

Valid until 11th August 2020

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany
www.passivehouse.com

Date of birth:

is hereby granted to use the seal depicted below until the expiration of this certificate in five years' time. During the validity period the recipient will be listed as a Certified Passive House Tradesperson online at `www.passivehouse-trades.org`. The awarded title and seal are to be used only in conjunction with the recipient's name.

The qualification was obtained in accordance with the examination regulations from 1st April 2012 and awarded upon successful completion of the Certified Passive House Tradesperson examination.

The examination was held on 14th March 2015 in Wrocław, Poland, by Polski Instytut Budownictwa Pasywnego / Schlagowski, Günter .

In addition to Passive House Basics, the examination had the following specialisation:

☑ **Building Envelope** ☑ **Building Services**

CERTIFIED
PASSIVE HOUSE
TRADESPERSON

TRADESPERSON

Darmstadt,
11th August 2015

Wolfgang Feist

Prof. Dr. Wolfgang Feist

This certificate does not replace any required professional qualification.

- Option B: Finalisation of the programme and acquiring Certificate of the Academy of Healthy Building - for free after completing the training. The participant receives a certificate of the only unit in Poland that is accredited by the German and Polish Institute for Passive Building to conduct Training Programs and International Examinations in Passive and Energy-Efficient Building according to PHI Darmstadt.


GREEN CHERRY ARCHITECTURE
Akademia Zdrowego Budownictwa
1 WRZESIEŃ 2020

CERTYFIKAT
ukończenia szkolenia

Jan Kowalski

odbył szkolenie .... II STOPNIA: Mistrz Budownictwa Pasywnego i Energooszczędnego

w dniach................................ 01.07 do 01.09.2020

Certyfikat został przyznany na podstawie przeprowadzonego szkolenia przez:

arch. KAMILA WIŚNIEWSKIEGO
Akademia Zdrowego Budownictwa

Trenera akredytowanego przez:
Passive House Institute

1 WRZESIEŃ 2022
Data ważności

DYREKTOR Biura PiBPiEO Łukasz Krzysztoń
Dyrektor Instytutu

GREEN CHERRY ARCHITECTURE arch. Kamil Wiśniewski
Kamil Wiśniewski
Akredytowany trener

Trainings of FPE - Energy Conservation Foundation [7]

Energy Conservation Foundation was established in 1992. It is a non-profit organization and a Business Environment Institution which focuses its efforts on issues related to energy efficiency. Energy Conservation Foundation, as the first one in Poland, published the standard for Energy Auditing and commenced training for the energy audit activities. The Foundation participated in work and studies on the implementation of EU Directive on buildings' energy performance in Poland.

FPE is registered in the Register of Training Institutions of the Provincial Labour Office in Warsaw under number 2.14/00294/2012. They organize training courses subsidized by the National Training Fund and the District Labour Offices.
We are in the Polish Agency for Enterprise Development (PARP) Database of Development Services with the possibility of co-financing development services.

- **ENERGY EFFICIENCY AUDITS**
  The aim of the training is for participants to gain the knowledge and skills necessary to prepare energy efficiency audits in accordance with the Energy Efficiency Act (Journal of Laws 2016, item 831). These audits are the basis for applying for energy efficiency certificates (white certificates). 24 hours in total. Currently the training is realized online, and the program is following:
    - Introduction (introduction to the mechanisms of preparing energy efficiency audits) – 2h
    - Lecture - Regulations, laws and procedures – 1h
    - Workshop - Example of Energy Efficiency Audit – 2h
    - Lecture - Fundamentals of heat transfer and building physics – 1h
    - Workshops in accordance with the scope of the Announcement of the Minister of Energy dated November 23, 2016. Insulation of industrial installations – 2h
    - Workshops in accordance with the scope of the Announcement of the Minister of Energy dated November 23, 2016. Modernization or replacement of local district heating networks and local heat sources. Reducing losses in district heating networks -2h
    - Workshops in accordance with the scope of the Announcement of the Minister of Energy dated November 23, 2016. Building reconstruction or renovation: insulation of walls, ceilings, floors, flat roofs and elimination of thermal Bridges, modernization or replacement of window and door woodwork and shading devices; modernization of central heating and hot water, modernization of ventilation and air conditioning – 4h
    - Lecture - Energy management systems in buildings, installation measurement and control devices – 2h
    - Workshops in accordance with the scope of the Announcement of the Minister of Energy dated November 23, 2016. Energy recovery in industrial processes in the scope: heat recovery systems, freecooling – 2h
    - Lecture - Physical basis of energy efficiency of electrical machines and equipment – 2h

[7] All information translated from the FPE website: https://fpe.org.pl/szkolenia/

  - Workshops in accordance with the scope of the Announcement of the Minister of Energy dated November 23, 2016. Upgrading or replacing: lighting, equipment and installations used in industrial processes or in energy, telecommunications, information technology processes. Loss reduction: reactive energy consumption and transformation.

- **COMPANY ENERGY AUDIT**
  Training intended for people interested in preparing energy audits of enterprises, in accordance with the Act of 20 May 2016. (Journal of Laws 2016 item 831). The training is conducted in the form of lectures and workshops. 22 hours in total. Currently the training is realized online, and the program is following:
  - Lectures – 5h
    - Principles of energy efficiency
    - Formal basis included in the Energy Efficiency Act (Journal of Laws 2016, item 831) and Directive 2012/27/EU on energy efficiency
    - Interpretation of the obligation to conduct an audit and its formal procedure
    - Theoretical basis for performing audits energy audits of enterprises
    - Audit procedure according to PN-EN 16247
    - Practical aspects of performing audits, the adopted assumptions and interpretation of regulations
  - Lectures and workshops – 4h
    - Analysis of the existing state and presentation of the energy audit of the company
    - Sample energy audit report
    - Methods for estimating the energy, economic and environmental effects of retrofit measures
  - Workshops – 5h
    - Implementation of the audit in the company, kick-off meeting, establishment of balance boundaries, acquisition of input data
    - Evaluation of the energy characteristics of the company components and analysis of energy consumption trends
    - Determination of the energy result indicator and the amount of baseline energy
  - Workshops – 4h
    - Examples of retrofitting measures with energy, economic and ecological effects including life cycle analysis
  - Workshops and lectures – 4h
    - Determination of the energy result indicator after conducted modernizations
    - Report from the energy audit of the company and the report for the president of the Energy Regulatory Office

- **ENERGY AUDIT AND RENOVATION OF BUILDINGS**

The purpose of the training is to provide knowledge and skills necessary for the preparation of thermo-modernization and renovation audits of residential and public buildings in accordance with the Act on supporting thermo-modernization and renovation (Journal of Laws 223/2008, item

1459, as amended in 2020) and the Regulation on the scope and form of energy and renovation audits (Journal of Laws 43/2009, item 346), as amended (Journal of Laws of 2020, item 789). 22 hours in total. Currently the training is realized online, and the program is following:

- Lectures – 9h
  - Energy and renovation audits - legal basis
  - Proposals of modernization/renovation activities in buildings
  - Energy audits - procedure for performing energy and renovation audits

- Exercises – 5h
  Energy audits - performing a sample energy audit of a multi-family residential building in the OZC Auditor programme and MS Excel sheet in the scope of:
  - description of the existing condition,
  - improvement of thermal insulation of external walls,
  - roof,
  - windows in premises and staircases,
  - modernization of central heating and hot water installations,
  - calculation of thermomodernization bonus/premium.
- Exercises
  Renovation audits - introduction to exercises and performing a sample renovation audit of a multi-family residential building multifamily residential building in OZC Auditor programme and MS Excel spreadsheet in the scope of:
  - improvement of thermal insulation of external walls,
  - roof,
  - windows in premises and staircases,
  - modernization of heating and hot water installations,
  - renovation of staircases,
  - replacement of electrical installation,
  - calculation of renovation premium/bonus.

- **ENERGY PERFORMANCE CERTIFICATES FOR BUILDINGS**

The aim of the training is for participants to gain the knowledge and skills necessary to draw up energy performance certificates for buildings in accordance with the Regulation of the Minister of Infrastructure and Development of 27.02.2015 on the methodology of determining the energy performance of a building or part of a building and energy performance certificates (Journal of Laws 2015 item 376). 16 hours in total. Programme:

- Methodology for drawing up energy performance certificates – 2h
- Developing an energy performance certificate for a residential building (without cooling) in a spreadsheet – 6h
- Creating energy performance certificates for public buildings in Audytor OZC programme -8h

- **USE OF THERMAL IMAGING FOR THE DIAGNOSIS OF THERMAL PROTECTION OF BUILDINGS**

The training is designed for people who want to expand their auditing or consulting activities in the field of energy efficiency with a new type of service which is the thermal imaging diagnostics.

Thermovision diagnostics is used to assess the condition of thermal insulation of the building being prepared for thermo-modernization, as well as to assess the quality of the insulation made. As part of the training, participants will gain knowledge and skills in the following areas:

- use of the thermovision camera
- interpretation of thermovision images
- elaborating report on the assessment carried out

- **DATA ANALYSIS METHODS FOR ENERGY AUDITORS**

A course introducing methods of data analysis in a spreadsheet. The formula of the course is practical workshops on own laptops. During the classes, calculation examples will be performed based on data from real energy audits. 12h of training. Scope of the training:

- Workshop conducted in Excel illustrating:
    - automatic sorting and selection of data
    - ordering data with an appropriate time interval
    - obtaining hourly outdoor temperature data based on daily minimum and maximum
    - determination of the energy result depending on two mutually correlated variables
- Workshop conducted in Excel illustrating:
    - use of database functions
    - hourly modelling of a gas boiler house operation
    - power optimization of two sources with different heat costs

- **BLOWER DOOR TEST: BLOWER DOOR - THEORETICAL AND PRACTICAL ASPECTS OF PERFORMING A BLOWER DOOR TEST**

  During the training the following questions will be answered:
    - What is building airtightness and why is it important?
    - How the law and building regulations govern the rules on building airtightness?
    - What is the Blower Door airtightness test, how to perform it correctly and what should I pay attention to while performing it?
    - What can be done to make a building airtight? How to identify leaks and limit them?
    - What does the test and report look like?

  Training scope:
  - Theory:
    - Air tightness of buildings
    - Legal issues and regulations
    - Discussion of theoretical aspects concerning Blower Door airtightness test
  - Practice:
    - Overview of the Blower Door device and its components
    - Preparing the device for the test. Entering data into the computer program
    - Execution of the airtightness test and preparation of the report

The Polish National Energy Conservation Agency (KAPE)[8]

The Polish National Energy Conservation Agency (KAPE) operates since 1994, continually broadening its services in the field of energy efficiency and renewable energy sources (RES), as well as its client list from both the public and private sectors. We aid companies, municipalities, public institutions, and

[8] All information translated from the KAPE website: https://www.kape.gov.pl/page/szkolenia

non-governmental institutions through advice, instruction and education in the field of rational energy use. The satisfaction of our clients is the measure of the quality of our services. Our mission is the dissemination and implementation of the world's best standards and practices in the fields of energy efficiency and sustainable development, upon which we construct optimal energy efficient solutions for our clients. Our strategic goal is supporting the growth of competitiveness of the polish economy through improving energy efficiency, while respecting the principles of sustainable development.

- **Energy efficiency of enterprises and the white certificates system**

Training for managers and senior technical staff, during which we explain the operation of the system and the process of obtaining funds to support investment in energy efficiency. During the training we present opportunities and threats associated with the system, as well as the possibility of obtaining additional funds for improving energy efficiency, which can be combined with the system of white certificates.

- **Training for the construction industry "Practical aspects of drafting requirements and criteria for evaluating offers in public procurement".**

The trainings are organized for Contractors who compete for contracts for investments that take into account environmental aspects and energy efficiency issues, in particular for thermomodernization and lighting investments.

Online course "Energy Efficiency in SMEs"

PARP (Polish Agency for Enterprise Development) Academy invites launched in 12.2020 free online course "Energy Efficiency in SMEs". The course contains practical advice and tips how to conduct step by step energy efficiency project in your company. Duration: 6h
The course was developed in cooperation with the Ministry of Climate and Environment, National Energy Conservation Agency - KAPE and PARP Academy team.

By taking the course "Energy Efficiency in SMEs" the participant will:

- understand what energy efficiency and energy auditing is;
- learn how to correctly manage and monitor energy;
- learn about cost-free energy saving measures and adapt them to company;
- learn about the most cost-effective energy efficiency measures in different areas of the company;
- learn how to determine the economic viability of energy efficiency measures;
- learn about possible forms of support for energy efficiency projects;
- know where to look for information on available financing tools.

The PARP Academy online course offer is completely free of charge. Completion of each online course gives the opportunity to obtain a certificate by its participants without leaving home.

Chapter 1 Introductory Module
Lesson 1.1 Energy consumption in your company
Lesson 1.2 Step by step implementation of an energy efficiency improvement project

Lesson 1.3 Low and no-cost energy saving measures
Lesson 1.4: How to calculate the economic cost of your project
Chapter 1 Test

Chapter 2: How to reduce energy consumption in buildings
Lesson 2.1 Energy efficient lighting
Lesson 2.2 Ensuring thermal comfort
Lesson 2.3: How to make a building thermally efficient
Chapter 2 Test

Chapter 3. the use of electricity, heat and cooling in the enterprise
Lesson 3.1 Energy efficient appliances
Lesson 3.2: Your own sources of electricity
Lesson 3.3 Custom heat sources
Lesson 3.4 Electricity tariffs
Lesson 3.5 Transport
Lesson 3.6 Optimizing personnel and process management
Chapter 3 Test

Chapter 4 Financing energy efficiency improvement projects
Lesson 4.1: How to make money from energy savings?
Lesson 4.2: Where to find information on available support?
Lesson 4.3 ESCO investment implementation
Chapter 4 Test

Chapter 5 Energy efficiency - do it yourself
Lesson 5.1: Video: Energy Saving Calculator
Lesson 5.2: Video: The SME e-Adviser
Lesson 5.3: Video: Self-audit

EUROCON courses[9]
EUROCON is a young but rapidly growing national and international training and consulting company. The aim of their activity is to provide services for the energy, financial, chemical, environmental, pharmaceutical and many other sectors.

- **Energy efficiency support system - established solutions and directions for change**
  After the workshop, an electronic certificate will be sent to each participant (paper version sent on request).

  9.00-9.45 Directive of 11.12.2018 No. 2018/2002 amending Directive 2012/27/EU on energy efficiency - key assumptions affecting national law.

[9] All information translated from the EUROCON website: https://euro-con.pl/pl/wydarzenia/szkolenia

9.45-12.00 Energy Efficiency Law - directions of proposed changes by the amendment of 19.08.2020. - Structure and basic entities of the novelty market:

- The most important concepts determining the essence of support, including novelty - the definition of the start of work aimed at the implementation of the project;
- Performance contract - new areas,
- Entity scope of application of the Act;
- Material scope of application of the Act - new scope of obliged entities - liquid fuels market;
- New obligations of NFOŚ,
- What about gas consumption for non-energy purposes?
- Methods of settling obligations - project implementation, certificates, substitute fee - what, when, how much, how?
- Non-refundable subsidy programs - a new way to implement the efficiency obligation? Scope and obligations!
- New commodity exchange obligations - annual weighted average price of property rights,
- Scope of projects that can be submitted for the obligation - are there any limitations?
- New approach to accounting for the performance of the obligation can you still account after one, two or maybe three years?
- New level of national obligation,
- Alternative measures and their impact on meeting the national obligation.
- Central register of final energy savings.

11.00-11.15 Break

12.00-13.15 Audits of established solutions and novelties

- Confirmation of the savings achieved for the purpose of white certificates:
- Energy efficiency audits as the basic tools to confirm the achieved savings;
- Types of audits, the minimum information required by law and the rules for their preparation;
- New scope of exemption from mandatory auditing;
- New approach to verification of energy efficiency audits;
- Requirements for the auditor;
- Failure to achieve required energy savings and sanctions defined in the law on energy efficiency

Law on Energy Efficiency.

- Energy efficiency audit for enterprises - scope of obligation and its verification - changes:
- Entities obliged to comply with the obligation and rules for its implementation, including the audit contractor, minimum information required by the regulations;
- New scope of exemptions from the audit;
- New approach to audit procedure;
- New approach to informing the President of URE about the audit.

13.15-14.00 Break

14.00-15.00 White certificates, including settlement of the obligation

- Scope of projects for which white certificates may be obtained;
- Exclusions and limitations in the use of the white certificates system;

- Rules for issuing energy efficiency certificates;
- Rules for determining the value of energy efficiency certificates,
- Verification of final energy savings,
- Notification of completion of the project - a new approach,
- Application for correction of issued certificates - new solutions;
- Possibility of obtaining certificates and starting work - how not to lose support?
- Sanctions for "false" information - scope and normative procedure of the ERO.

15.00-15.30 Principles and scope of imposing fines
- Settlement of white certificates obligation, including for energy-intensive enterprises - obliged entities;
- Liability for failure to present an audit;
- Principles of imposing fines by the ERO President;
- Scope of court protection - recent case law.

15.30-16.00 Amendments to other acts and transitional provisions
- "Efficiency" changes in the Energy Law;
- Possibility of settling for two or three years in the interim period;
- Time horizon for implementation of the obligation;
- Entry into force of the Act.

16.00-16.30 Summary, discussion and closing of the meeting.

- **ENERGY AUDIT OF THE COMPANY**

DAY 1

9.00-10.20 Energy Market in Poland - micro and macro environment
- knowledge test
- Energy market in Poland - analysis of the environment

10.30-11.45 Legal conditions of audits
- European Union Directives
- Law on energy efficiency
- Announcements of the Minister of Energy of 23 November 2016 including key aspects;

11.45-12.30 Energy audits of enterprises - formal requirements
- Formal basis for performing audits (who can or must perform an audit, who performs - auditor's powers);
- Principles of energy efficiency

12.45-13.45 PN-EN 16247 standard
- Audit procedure according to PN-EN 16247

13.45-14.15 Summary of the first day, questions, discussion.

DAY 2

9.00-10.30 What is an Energy Audit of a Company?
- Practical aspects of performing audits, accepted assumptions and interpretation of regulations
- Comparison of different types of audits

10.40-12.30
- Audit implementation in the enterprise, kick-off meeting, establishing the balance boundaries, obtaining input data;

- Evaluation of energy features of the enterprise's elements and analysis of energy consumption trends;
- Determination of the energy result indicator and the size of the baseline energy
- Analysis of the existing state and presentation of the results of the energy audit of the enterprise;
- Methods of estimating the energy, economic and environmental effects of modernization measures
12.45-14.00
- Examples of retrofit measures with identification of energy, economic and environmental effects including life cycle analysis
- Modernization or replacement - Local district heating networks and local heat sources;
- Reducing losses - in district heating networks
- Energy recovery in industrial processes in the field of: - heat recovery systems - freecooling
- Modernisation or replacement of: - lighting - equipment and installations used in industrial processes or in energy, telecommunications, IT processes Loss reduction: - reactive energy consumption and transformation
- Company energy audit report and report for the President of the Energy Regulatory Office
14.00-14.45 Summary, opportunity for individual consultations, discussion and closing the meeting

Other EUROCON courses:

1. Major amendment to the Energy Law - new rules for functioning in the electricity market
2. ENERGY MARKETING INFORMATION OPERATOR 2021.
3. HOW TO SELL ENERGY FROM RES DIRECTLY TO INDUSTRIAL CONSUMERS
4. Taxation of electricity derived from RES
5. MODELS OF ENERGY ACQUISITION FROM OZE BY INDUSTRIAL CONSUMERS
6. Energy Storages
7. TARIFF FOR DISTRIBUTION OF ELECTRICITY
8. Heat tariffs - a comprehensive view of a changing heat market

EnMS courses[10]

EnMS Polska was founded in 2010 to meet the expectations of our clients, who are aware of the fact that energy costs – which constitute a significant part of the annual budget – can be controlled and reduced just like any other operating cost. We are a reliable company with a well-established position on the market.

- ENTERPRISE ENERGY MANAGEMENT: https://www.enms.pl/en/szkolenia/zarzadzanie-energia-w-przedsiebiorstwie/
- ENTERPRISE ENERGY AUDIT ACCORDING TO THE REQUIREMENTS OF DIN EN 16247: https://www.enms.pl/en/szkolenia/audyt-energetyczny-przedsiebiorstwa-wg-wymagan-normy-pn-en-16247/
- INTRODUCTION TO THE ENERGY MANAGEMENT SYSTEM ACCORDING TO ISO 50001: https://www.enms.pl/en/szkolenia/wprowadzenie-do-systemu-zarzadzania-energia-wedlug-normy-iso-50001/
- INTERNAL ENERGY MANAGEMENT AUDITOR OF SYSTEM ACCORDING TO ISO 50001: https://www.enms.pl/en/szkolenia/audytor-wewnetrzny-systemu-zarzadzania-energia-wedlug-iso-50001/

[10] All information from the ENMS website: https://www.enms.pl/en/szkolenia/. Information available in English.

- ENERGY MANAGEMENT SYSTEM ACCORDING TO ISO 50001 IN PRACTICE: https://www.enms.pl/en/szkolenia/system-zarzadzania-energia-wedlug-iso-50001-w-praktyce/
- ENERGY EFFICIENCY AUDITOR: https://www.enms.pl/en/szkolenia/audytor-efektywnosci-energetycznej/
- ENERGY AUDITOR/ENERGY EFFICIENCY AUDITOR https://www.enms.pl/en/szkolenia/audytor-energetyczny-audytor-efektywnosci-energetycznej/
- AUDIT OF ELECTRICAL EQUIPMENT AND INSTALLATIONS - METHODOLOGY FOR CALCULATING ENERGY SAVINGS https://www.enms.pl/en/szkolenia/audyt-efektywnosci-energetycznej-urzadzen-instalacji-elektroenergetycznych-metodyka-obliczania-oszczednosci-energii/
- ENERGY EFFICIENCY AUDIT. PRACTICAL ASPECTS OF THE SELECTION OF COGENERATION SYSTEMS https://www.enms.pl/en/szkolenia/audyt-efektywnosci-energetycznej-praktyczne-aspekty-doboru-ukladow-kogeneracyjnych/
- NEW RULES FOR SUPPORT FOR COGENERATION UNITS https://www.enms.pl/en/szkolenia/nowe-zasady-wsparcia-jednostek-kogeneracji/

AGM Consulting courses[11]

We have been on the market since 1999, and such a long period of active operation allowed us to develop well and systematize our consulting and training activity. We use external trainers and training companies cooperating with us. We offer both outdoor and stationary trainings.

Our company provides training in energy efficiency in the traditional way, i.e. in the form of physical meetings with you. At the same time, modern technologies and the situation of the prevailing epidemic mean that all services are also conducted as videoconferencing and on an e-learning platform.

Training in energy efficiency

Purpose of training: gaining knowledge and skills to improve the competitiveness, profitability and potential of an enterprise.
Participant profile: anyone wishing to reduce the energy intensity of various processes in their company.
Form of training: course combined with exercises.
Date and place: to be established
* possibility to organize closed trainings
Price: to be agreed

1. Energy Efficiency Training Program:
2. Presenting the three basic network systems, supply of energy carriers to the end user:
    (a) electricity,
    (b) natural gas and liquefied petroleum gas,

[11] All information translated from the AGM website: https://www.agm-konsulting.pl/o-nas/

(c) district heating.

3. National Electricity System - NPS; discuss the basic opportunities and constraints in the development of pro-consumer movement.
4. The National Gas Transmission Network - discussion of opportunities for development of power generation using the most environmentally friendly fossil fuel.
5. Problems with theoretical calculation of real energy characteristics of buildings.
6. Discussion of some techniques of calculating additional and unwanted fees for the supply of energy carriers.
7. Building plus-energy.
8. Smart grid as a chance to control the prosumer chaos inside the National Power System.
9. Micro cogeneration.
10. Domestic fuel cells with high efficiency.
11. Production of cold from the grid heat and from thermal collectors
12. Photovoltaics.
13. Fuel production from solar energy
14. Energy management system as an opportunity to master a facility powered by multiple energy sources.

Energy management in an enterprise is a particularly important issue for any company. Expenses on utilities consume huge resources, so optimization in this area can lead to considerable financial benefits! That is not all, as a good energy management system always has a positive impact on the environmental aspect, which can translate into brand PR.

Energy Efficiency - Training

Optimal energy management in a company is not difficult, however, you need to stick to several important principles, which you will learn in the training offered by our company. It is addressed to every person interested in this issue. Both for owners and employees of enterprises.

APPENDIX B - ENEFFECT BULGARIA

APPENDIX B 1

No	Table 2: Country specific learning outcome and qualitfications	EQF LEVEL		
	Architectural design roles Architect (ARCH)	ARCH		
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**			
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	5		
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	5		
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	4		
1.4	Summarize the ideas of digital space and asset management.	2		
1.5	Explain the added value of using energy model open file formats to ensure interoperability.	2		
1.6	Explain the main contents and apply relevant parts of national energy guidelines.	4		
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**			
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	5		
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	4		
2.3	Explain relations between life-cycle costs, energy performance and building performance.	4		
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	4		
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	4		
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**			
3.1	Explain the overall design process for energy-efficient building.	5		
3.2	Assist client to set realistic and achievable energy and building performance target.	6		

3.3	Perform preliminary energy analysis in the early project stages for both new and renovation projects to add value for the decision making.	4		
3.4	Assist the client to set and specify information requirements.	5		
3.5	Explain how to support owner's effective decision-making and opinion formation of other stakeholders.	5		
3.6	Illustrate how to direct the design towards set targets utilizing the capacity of different kinds of assessment methods relevant for building design.	5		
3.7	Explain the flow of design teamwork and demonstrate how to prepare, compare and improve alternative concepts.	6		
3.8	Lead / assist the tasks related to technical documents for the building authorities.	6		
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**			
4.1	Apply the set performance targets related to building design into BIM-based design process.	5		
4.2	Iterate the design solutions to meet the set targets of building performance and energy efficiency.	5		
4.3	Consider options of renewable energy and optimize its potentials.	4		
4.4	Create different energy efficient design concepts renewable energy systems.	4		
4.5	Perform energy analyses including dynamic simulations.	2		
4.6	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2		
4.7	Perform lightning calculations, analyses and simulations.	2		
4.8	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4		
4.9	Use life cycle cost calculation including life-cycle studies changing influential design parameters.	4		
4.10	Share the results of energy simulations, discuss the options and update domain BIMs.	5		
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**			
5.1	Prepare the Architectural domain model on the basis of set targets and definitions.	6		
5.2	Create and update digital (BIM-linked) building specification with material and dimensional information to reflect owner's quality and performance requirements.	5		
5.3	Explain essential issues of the needs of initial information and the potentials of different inventory surveys in refurbishment projects.	5		
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4		

5.5	Prepare/assist information needed for specific use cases such as bill of quantities.	4		
5.6	Prepare/assist the domain model for simulation and assessment.	6		
5.7	Prepare/assist models and information for planning authority and in required data format.	6		
5.8	Prepare/assist models and information for procurement.	5		
5.9	Prepare models to fulfil quality and information requirements for quality control and assurance processes.	5		
5.10	Prepare models based on data and information requirements of sustainable care and maintenance processes.	5		
5.11	Prepare information for As-Built Models and Maintenance model for utilization of client and building management.	4		
5.12	Prepare/assist in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performance requirements.	5		
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**			
6.1	Describe the essential parts of the procedure for BIM based collaboration.	6		
6.2	Describe different collaborative interdisciplinary and open BIM working methods, tools and processes.	5		
6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	6		
6.4	Prepare relevant visualization models to enable information sharing, decision making and opinion formation.	6		
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	5		
6.6	Collaborate with the help of communication platforms and processes.	6		
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**			
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	5		
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	5		
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for architectural building design.	6		
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	6		

7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	5		
7.6	Instruct and audit contractors on construction site on critical points.	6		
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	5		
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**			
8.1	Use domain specific BIM authoring applications for building design and analysis.	6		
8.2	Use relevant energy design calculations and assessment tools in different design phases.	3		
8.3	Use different tools for BIM-based collaborative working.	5		
8.4	Create combination model and use model checking tools for clash detection.	4		
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	3		
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	5		
8.7	Prepare the domain model for simulation and assessments	4		
8.8	Use tools for environmental impact analyses.	4		
8.9	Use project data and file management systems.	4		

Sources:

1) Elective course "Management of energy-efficient renovation of buildings" in 5th year Architecture (AF) - 30 hours of lectures, implemented under the European project "Innovative training schemes for retrofitting to nZEB-levels - Fit to nZEB" (see -down).
2) Regular course "Building Physics" in 1st year Architecture (AF) - 30 hours of lectures
3) Regular course "Building Physics - course assignments" in 1st year Architecture (AF) - 15 hours of exercises
4) Regular course "Building Construction" in 1st and 2nd year Architecture (AF) - 60 hours of lectures
5) Regular course "Technical installations and systems" in 3rd year Architecture (AF) - 30 hours of lectures
6) Regular course "Architectural constructions" in 3rd year Architecture (AF) - 30 hours of lectures
7) Regular course "Energy Efficient Architecture" in 4th year Architecture and Urbanism (AF) - 30 hours of lectures
8) Elective course "Energy efficient behavior of buildings" in 5th year Architecture and Urbanism (AF) - 15 hours of lectures + 45 hours of exercises
9) Elective course "Sustainable Architecture of Buildings" in 5th year Architecture and Urbanism (AF) - 30 hours of lectures

10) Elective course "Environmental Policy and Sustainable Development" in 5th year Architecture (AF) - 30 hours of lectures
11) Elective course "Building Envelope Technology" in 5th year Architecture (AF) - 30 hours of lectures
12) Regular course "Construction Organization" in 5th year Architecture (AF) - 30 hours of lectures
13) Elective course "Ecology in the territorial - settlement structure and architecture" in 5th year Architecture (AF) - 30 hours of lectures
14) Elective course "Specialized Computer Technology" in 5th year Architecture (AF) - 15 hours of lectures + 15 hours of exercises
15) Elective course "Modern spatial policies for sustainable development" in 5th year Urbanism (AF) - 30 hours of lectures
16) Regular course "Reconstruction of buildings" in 5th year Architecture (AF) - 30 hours of lectures

APPENDIX B2

Construction work roles Site manager (SM), Construction site workers and installers (CW)		SM	CW
LO1	**ULO 1. Healthy and safe conditions of work**		
1.1	Participates in the establishment of an organization for the implementation of preventive activities for environmental protection	4	3
LO2	**ULO2. Economics**		
2.1	Knows the basics of market economy	2	2
2.2	Knows the characteristics of the activity in a construction company	2	2
LO3	**ULO5. Use of information and communication technologies (ICT) in the professional activity**		
3.1	Processes information with ICT	2	2
3.2	Communicates through ICT	2	2
3.3	Creates digital content with ICT	2	2
3.4.	Provides protection of the electronic environment	2	2
3.5	Solves problems in working with ICT	2	2
LO4	**ULO7. Basic construction products (materials, products, kits or systems) and their purpose**		
4.1	Reads working drawings, assembly plans, specifications	4	3
4.2	Knows the main construction products (materials, products, kits or systems) and their field of application	4	3
4.3	Knows the basic elements of the building	4	3
LO5	**ULO8. Preparation for development of technical documentation for investment project and for issuance of construction site**		
5.1	Draws the dimensions of existing objects	4	n/a
5.2	Develops investment projects, bids and tender documentation	4	n/a
5.3	Prepares the site for issuance of permits	4	n/a

LO6	**ULO9. Earthworks and construction works for rough construction (formwork, reinforcement, concrete, masonry, roofing works)**		
6.1	Organizes the implementation of earthworks on the construction site	4	3
6.2	Organizes the implementation of construction and installation works for rough construction, reconstructions and major repairs	4	3
6.3	Evaluates the performed earthworks and construction works during rough construction, reconstructions and major repairs	4	3
LO7	**ULO 10. Finishing works - plasters, ground coating, putties, floorings, painting and tinsmithing, insulation works, constrction carpentry**		
7.1	Organizes the implementation of finishing works on the construction site - new construction, reconstruction and ongoing repairs	4	3
7.2	Evaluates the completed finishing works	4	3
LO8	**ULO 11. Preparation and installation of prefabricated structures**		
8.1	Organizes the installation of prefabricated structures	4	3
8.2	Evaluates the finished prefabricated structure	4	3

Profession 582010 "Construction Technician" (IV EQF level)
Specialty:

- 5820101 "Construction and Architecture"

Valid standard: State Educational Standard adopted with Ordinance №7 / 11.03.2020

Relevant occupations:
3112-3004 Technician, civil engineering (designer);
3112-3007 Technician, investor control;
3112-3009 Technician, construction and architecture;
3112-3010 Construction technician, design and technical department;
3123-3001 Technical Construction Manager;
3334-3001 Agent, real estate;
3334-3003 Agent, property management

Comment: The specific references to energy efficiency/nZEB are concentrated in ULOs 9: "Earthworks and construction works for rough construction (formwork, reinforcement, concrete, masonry, roofing works)"and 10: "Finishing works - plasters, ground coats, screeds, floorings, painting and tinsmithing, insulation works, construction carpentry". The references are mostly targeted to the passive house standard, formulated in the following way:

LO 9.2: Describes the principles of the "passive" building

ULO9 Evaluation criteria: Demonstrates knowledge of the innovative method of construction of "passive buildings"

LO10.1: Lists the types of materials, articles and techniques for laying and installation in a "passive" building, Controls the parameters corresponding to the requirements for construction of a "passive" building, Monitors compliance with the rules for laying and installation in a "passive building"

LO10.2: Demonstrates knowledge of innovative finishing methods related to the construction of "passive" buildings

Although the above-listed references are by themselves relevant for achievement of LOs sufficient for application in real-life practice, they are too generic and do not emphasize on important aspects as the cross-craft understanding. The deficiencies are however overcome in a significant extent by the introduction of a specific discipline in the training plan “Ecological and energy efficient construction”.

Specific discipline: “Ecological and energy efficient construction”

The subject provides basic knowledge related to energy efficient construction. The energy efficiency of buildings is one of the main parameters of modern construction. Therefore, the program has sections to get students acquainted with modern materials for the implementation of thermal insulation systems, including environmental aspects. The basic principles in thermal insulation systems design are also studied. The training under the program also clarifies the main characteristics of passive buildings and the requirements and standards for sustainable construction.

This knowledge builds on the knowledge and skills acquired in the subjects construction technology, training practice in construction process technology and training practice in construction and installation work.

The aim of the program is, through the training on the subject "Environmental and energy efficient construction", to get students acquainted with current trends in modern construction, and through mastering the material to form professional competencies needed in the work of the construction technicians, considering the modern conditions and the dynamic changes in the profession.

2.Recommended topics by sections:

Section I. Modern trends in construction

Topic 1. Construction and ecology.

Topic 2. Legislation related to environmentally friendly and energy efficient construction.

Section II. Energy efficiency of buildings

Topic 1. Basic concepts related to energy efficiency.

Topic 2. Heat losses in buildings. Thermal bridges - types.

Topic 3. Insulation systems in buildings - general information.

Topic 4. Thermophysical properties of materials. Thermal conductivity coefficient - significance.

Topic 5. Modern materials for thermal insulation. Ecological thermal insulation materials.

Topic 6. Thermal insulation systems of walls, floor structures, roofs and other elements in the building - sample schemes and basic principles of construction

Section III. Design of thermal insulation system

Topic 1. Coefficient of heat transfer U - nature, meaning, benchmarks.

Topic 2. Calculation of the coefficient of thermal conductivity /*practical task on an individual assignment*/

Topic 3. Calculation of the coefficient of thermal conductivity with electronic calculator.

Section IV. Sustainable construction - construction of the future

Topic 1. Standards for sustainable construction.

Topic 2. Certification of buildings according to the standards for sustainable construction.

Topic 3. Passive buildings - basic parameters. NZEB.

Topic 4. Ecological construction and "green" buildings

IV. Expected learning outcomes - knowledge, skills and competences

At the end of the training, students must have the following knowledge, skills and competencies:

knowledge of:

- basic concepts related to energy efficiency of buildings;
- modern thermal insulation materials;
- ecological materials;
- modern trends for energy efficient and environmentally friendly construction.

skills:

- to calculate the coefficient of thermal conductivity of an envelope in the building;
- to analyze the degree of energy efficiency of enclosing elements;
- to choose a suitable thermal insulation material for a specific thermal insulation system;

competencies:

- responsibility in performing the assigned tasks;
- logical thinking and creativity;
- shows a desire for professional development and career development.

582040 "Builder-installer" (III EQF level)

Specialties:

- 5820404 "Windows and glazing"
- 5820405 "Insulation in construction"

Valid standard: State Educational Standard adopted with Ordinance № 21 / 23.08.2019

Comment: No specific reference to nZEB, energy efficiency or RES, despite existing references to the specific parameters of the materials and the requirements to their application. Despite the recent adoption of the standard, improvements are necessary. The deficiencies could be partially overcome through interventions in respective plans, programmes and training aids.

Relevant occupations:

712 "Builders of buildings and related activities ",
7134 "Construction finishing workers and related workers"
7214 "Manufacturers and installers of metal structures"

3. 582030 "Builder" (II EQF level)

Specialties:

- 5820306 "Interior cladding and floorings",
- 5820307 "Exterior cladding and floorings"
- 5820312 "Roofing"
- 5820304 "Masonry"
- 5820310 "Carpentry in construction"

Valid standard: State Educational Requirement adopted with Ordinance № 5 / 09.01.2012

Comment: No specific reference to nZEB, energy efficiency or RES

Professional occupations:

7111 "Builders of residential buildings",
7112 "Bricklayers and related to them"
7114 "Concrete workers, casing and related to them"
7121 "Workers in the construction and repair of roofs"
7122 "Workers on placement of floor coverings and claddings"
7123 "Plasterers",
7124 "Workers in insulation"
7125 "Workers in glazing"
7131 "Building painters and related to them"

APPENDIX B3

No	Table 6: Country specific learning outcome and qualitfications			
Maintenance work roles Facility manager (FM), Property manager (PM), Real estate manager (REM)		FM	PM	REM
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**			
1.1	Knows the connection of buildings with environmental protection and sustainable development.	7	7	7
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**			
2.1	Knows the technology and practice for developing state policy, strategies and programs for the development of the real estate management sector and in particular - the disciplines of facility management and property management.	7	7	7
2.2	Knows the legal and regulatory framework related to the management of buildings and the processes in them.	7	7	7
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**			
3.1	Has knowledge about the processes related to non-productive assets and the role of buildings in them.	7	7	7
3.2	Knows the macro-frameworks of energy and utility consumption.	7	7	7
3.3	Is aware of the prospects for the real estate sector in Bulgaria in the context of regional and European integration.	7	7	7
3.4	Knows the basic elements of corporate real estate management.	7	7	7
3.5	Know methods and approaches for risk management.	7	7	7
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**			
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**			
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**			
n.1	Applies what has been learned as theoretical knowledge and shared practical experience to solve problems in practice.	7	7	7
n.2	Prepares branch analyzes, diagnostics of the environment of the organization and of the organization itself.	7	7	7

n.3	Formulates goals and strategies, makes plans, exercises different types of control.	7	7	7
n.4	Carries out effective communication.	7	7	7
n.5	Plans and organizes their own work effectively.	7	7	7
n.6	Is able to use various sources of information and work with them independently.	7	7	7
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**			
	N/A			
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**			
	N/A			

Based on:
"Facility Management" Master's programme, **Sofia University "St. Kliment Ohridski"**
Full available description:
Focus, educational goals

There is no other area of the economy and economic life in the country and the region that needs reforms and investments as large in size, horizon and effect as the energy, infrastructure and utilities sectors.

Fundamental reforms in the energy and infrastructure sectors, such as demonopolisation, privatization and liberalization, regional and European integration, require a new generation of well-trained economists and managers. For a number of reasons, there are not enough active centers in the country, nor traditions in the training of such specialists.

The Master's program in Facility Management aims to fill this extremely important niche and to occupy leading academic, research and business positions in it. Its creation is in accordance with the policy and strategy of the Faculty of Economics of Sofia University "St. Kliment Ohridski" for bringing the master's programs closer to the practice and servicing its needs by well-trained specialists.

Facility management is a professional economic and managerial discipline focused on the efficient and effective provision of services to the organizations it serves. Facility management is responsible for the processes of integrating people, place and processes in the built environment, in order to improve the quality of life and productivity of the core business.

In particular, the program aims to prepare a completely new field of specialists for Bulgarian business, public administration and all areas where there is a need for professional real estate management.

Training (knowledge and skills necessary for successful professional activity; general theoretical and special training, etc.)

The program builds on the bachelor's degree in all specialties from all professional fields. It is structured in such a way as to offer high quality training at the master's level. Its design ensures the coverage of a wide range of topics and approaches from the practice of facility management.

The program starts with two introductory courses in facility management and property management, which cover the basic knowledge and skills in the field. Some of the key courses are dedicated to accounting in facility management, project management for the work environment, as well as digital innovations in facility and property management. Elective courses related to asset management, sustainable development and energy consumption in buildings are also offered.

In addition to exams as a traditional approach to assessing student progress, the educational process also includes solving practical problems, incl. within structured assignments. The program ends with the development of a master's thesis on a topic, jointly defined and implemented in cooperation with interested representatives from the sectors of facility management and property management. In this respect, the master's thesis could also serve as a tool to facilitate the transition to the labour market.

Professional competencies

Upon successful completion of the program, graduate masters must:

- In the theoretical and applied aspect:
  - ✓ Know the technology and practice for developing state policy, strategies and programs for the development of the real estate management sector and in particular - the disciplines of facility management and property management.
  - ✓ Know the legal and regulatory framework related to the management of buildings and the processes in them.
  - ✓ Have knowledge about the processes related to non-productive assets and the role of buildings in them.
  - ✓ Know the macro-frameworks of energy and utility consumption.
  - ✓ Know methods and approaches for risk management.
  - ✓ Know the connection of buildings with environmental protection and sustainable development.
  - ✓ Be aware of the prospects for the real estate sector in Bulgaria in the context of regional and European integration.
  - ✓ Know the basic elements of corporate real estate management.

- In the practical aspect:
  - ✓ To apply what has been learned as theoretical knowledge and shared practical experience to solve problems in practice.
  - ✓ To prepare branch analyzes, diagnostics of the environment of the organization and of the organization itself.
  - ✓ To formulate goals and strategies, to make plans, to exercise different types of control.
  - ✓ To carry out effective communication.
  - ✓ To plan and organize their own work effectively.
  - ✓ To be able to use various sources of information and work with them independently.

Professional development

Graduates of the program can find professional realization as specialists and managers in companies offering facility management and property management solutions and services, as well as in other enterprises and institutions, in which they can take responsibility for internal real estate management processes. Graduates can also find realization as experts, managers and consultants in the public administration and the non-governmental sector, as lecturers and researchers, etc.

APPENDIX B4

No	Table 4: Country specific learning outcome and qualifications	EQF Level	
	Building services design roles HVAC technician (HVACT), RES technician (REST), HVAC installer (HVACI), RES installer (RESI)	HVACT, REST	HVACI, RESI
LO1	**ULO 1. Healthy and safe conditions of work**		
1.1	Participates in the establishment of an organization for the implementation of preventive activities for environmental protection	4	3
LO2	**ULO3. Economics**		
2.1	Knows the basics of market economy	2	2
2.2	Knows the characteristics of the production activity in a company	2	2
LO3	**ULO5. Use of information and communication technologies (ICT) in the professional activity**		
3.1	Processes information with ICT	2	2
3.2	Communicates through ICT	2	2
3.3	Creates digital content with ICT	2	2
3.4.	Provides protection of the electronic environment	2	2
3.5	Solves problems in working with ICT	2	2
LO 4	ULO 7. Electrical engineering		
4 .1	Knows the basics of electrical engineering and automation	3	3
4 .2	Measures electrical quantities	3	3
4 .3	Draws / reads electrical drawings and diagrams	3	3
LO 5	ULO 8. Energy		
5 .1	Knows the types of machine elements, details and units in energy	3	3
5 .2	Calculates thermal values and hydraulic parameters	3	3
5 .3	Selects heating appliances, hydraulic machines and energy equipment	3	3

5 .4	Controls the thermal quantities and the automatic regulation systems	3	3
L06	ULO 25. Assembly and disassembly of equipment and installations for systems with RES		
6.1	Explains the principle of operation and design of facilities and installations for the production of electricity from renewable energy sources (solar, wind, geothermal and water energy, including energy from sea waves, tides)	4	4
6.2	Explains the principle of operation and design of facilities and installations for the production of thermal energy from renewable sources (solar, geothermal energy, waste heat, biomass energy, industrial and municipal waste and hybrid systems)	4	4
6.3	Installs / dismantles in accordance with the technical documentation equipment and installations for production of energy from renewable sources (wind generators, water turbines, biomass boilers, heat pumps, photovoltaic systems, solar heating installations and hybrid systems)	4	4
L07	Diagnosis and repair of equipment and installations for production of electricity and heat from RES		
7.1	Explains the ways to detect and eliminate damage in systems with RES	4	4
7.2	Performs technical inspection of equipment and installations for production of energy from renewable sources (wind generators, water turbines, biomass boilers, heat pumps, photovoltaic systems, solar heating installations and hybrid systems)	4	4
7.3	Organizes repair operations by performing technical control according to technological requirements	4	4
L08	Operation of facilities and installations for renewable energy systems		
8.1	Participates in a team in conducting tests and a 72-hour test of equipment and installations	4	4
8.2	Applies the roles for conducting prevention in accordance with the technological documentation	4	4
8.3	Supports the technological modes of operation of renewable energy systems and hybrid systems (wind turbines, water turbines, photovoltaic systems, solar thermal installations, biomass boilers, biogas and heat pumps)	4	4
8.4	Participates in planned and emergency shutdown of equipment and installations of systems with RES and hybrid systems	4	4
8.5	Uses specialized software programs in the activities for operation of RES systems, including hybrid systems	4	4
L09	Principles of the "Passive House" standard		
9.1	Explains the application of European directives in national energy efficiency programs and regulations	4	4

9.2	Analyzes the thermal characteristics of the building envelope of the existing building stock	4	4
9.3	Systematizes facilities and installations by energy classes	4	4
9.4	Offers innovative solutions for the introduction of renewable energy installations in the design of buildings with almost zero energy consumption	4	4
L 10	ULO 29. Assembly and disassembly operations of heating equipment, heating installations and installations for hybrid systems		
10 .1	Applies methodologies for calculation and selection of thermal equipment, heating and hybrid installations with the help of reference books and catalogs	4	4
10 .2	Installs / dismantles in accordance with the technical documentation the heating equipment and the individual elements of the heating installation and installation of hybrid systems	4	4
10 .3	Checks the suitability and safety of the heating equipment / heating installation and their compliance with the scheme of the installation	4	4
10 .4	Fills in a report for the performed installation activities	4	4
L 11	ULO 30. Diagnosis and repair of thermal equipment and heating installations and installations of hybrid systems		
11 .1	Performs technical inspection of heating equipment and heating installations, as well as installations of hybrid systems for detection of defects, malfunctions and damages	4	4
1 1 .2	Organizes the elimination of the detected damages in accordance with the technical documentation	4	4
1 1 .3	Controls the technological sequence of operations for repair of heating equipment, heating installations and installations of hybrid systems, observing the instructions and schedule for repair	4	4
1 1 .4	Restores the normal operation of the heating system and the installations of hybrid systems	4	4
1 1 .5	Fills in a report for the performed repair activities	4	4
L 12	ULO 31. Operation of heating equipment, heating installations and installations of hybrid systems		
12 .1	Put into operation heating equipment and heating installations, as well as installations of hybrid systems	4	4
12 .2	Participates in a team in conducting tests and a 72-hour test of equipment and installations	4	4
12 .3	Explains the rules for conducting preventive measures in accordance with the technological documentation	4	4
12 .4	Maintains the technological modes of operation of the heating systems with continuous control of the set parameters	4	4

12 .5	Participates in planned and emergency shutdown of heating installations and installations of hybrid thermal systems	4	4
L 13	ULO 32. Assembly and disassembly of air conditioning equipment		
13 .1	Applies methodologies for calculation and selection of air conditioning system with the help of reference books and catalogs	4	4
13 .2	Installs / dismantles in accordance with the technical documentation the individual elements (equipment and networks) of the air conditioning system	4	4
13 .3	Checks the suitability and safety of the air conditioning system	4	4
13 .4	Fills in a statement of findings for the performed installation activities	4	4
L 14	ULO 33. Diagnosis and repair of air conditioning equipment		
14 .1	Performs technical inspection of the air conditioning system to detect defects, malfunctions and damages	4	4
14 .2	Organizes the elimination of the detected damages in accordance with the technical documentation	4	4
14 .3	Controls the technological sequence of operations for repair of air conditioning systems, following the instructions	4	4
14 .4	Restores the normal operation of the air conditioning system	4	4
L 15	ULO 34. Operation of air conditioning equipment		
15 .1	Put into operation air conditioning systems and installations	4	4
15 .2	Participates in a team in conducting tests and a 72-hour test of equipment and installations	4	4
15 .3	Explains the rules for conducting prevention in accordance with the technological documentation	4	4
15 .4	Determines the mode of operation of air conditioning systems, using standard tables, nomograms , diagrams	4	4
15 .5	Maintains the technological modes of operation of air conditioning systems with continuous control of the set parameters	4	4
15 .6	Participates in planned and emergency shutdown of air conditioning systems	4	4
L 16	ULO 35. Assembly and disassembly operations of ventilation equipment		
16 .1	Applies methodologies for calculation and selection of the ventilation installation (facilities and networks) with the help of directories and catalogs	4	4
16 .2	Installs / dismantles in accordance with the technical documentation the individual elements (equipment and networks) of the ventilation system	4	4

16 .3	Checks the suitability and safety of the network in accordance with the scheme of the ventilation installation	4	4
16 .4	Fills in a statement of findings for the performed installation activities	4	4
L 17	ULO 36. Diagnosis and repair of ventilation equipment		
17 .1	Performs technical inspection of the ventilation system for detection of defects, malfunctions and damages	4	4
17 .2	Organizes the elimination of the detected damages in accordance with the technical documentation	4	4
17 .3	Controls the technological sequence of operations for repair of the ventilation installation (facilities and networks), observing instructions and schedule for repairs	4	4
17 .4	Restores the normal operation of the ventilation system	4	4
18	ULO 37. Operation of ventilation equipment		
18 .1	Put into operation ventilation equipment and installations	4	4
18 .2	Explains the rules for conducting prevention in accordance with the technological documentation	4	4
18 .3	Determines the mode of operation of ventilation equipment, using standard tables, nomograms , diagrams	4	4
18 .4	Maintains the technological modes of operation of the ventilation systems with continuous control of the set parameters	4	4
18 .5	Participates in planned and emergency shutdown of ventilation systems	4	4
L 19	ULO 38. Assembly and disassembly of refrigeration equipment		
19 .1	Applies methods for calculation and selection of refrigeration equipment (heating equipment) with the help of directories and catalogs	4	4
19 .2	Installs / dismantles in accordance with the technical documentation the individual elements (equipment and networks) of the refrigeration system	4	4
19 .3	Checks the suitability and safety of the network in accordance with the scheme of the refrigeration installation	4	4
19 .4	Fills in a statement of findings for the performed installation activities	4	4
L 20	ULO 39. Diagnosis and repair of refrigeration equipment		
20 .1	Performs technical inspection of the refrigeration system to detect defects, malfunctions and damages	4	4
20 .2	Organizes the elimination of the detected damages in accordance with the technical documentation	4	4
20 .3	Controls the technological sequence of operations for repair of refrigeration machines, equipment and installations, observing	4	4

	instructions and schedule for repairs		
20 .4	Restores the normal operation of the refrigeration system	4	4
L 21	ULO 40. Operation of refrigeration equipment		
21 .1	Puts into operation a refrigeration unit and a refrigeration system	4	4
21 .2	Participates in a team in conducting tests and a 72-hour test of equipment and installations	4	4
21 .3	Explains the rules for conducting prevention in accordance with the technological documentation	4	4
21 .4	Determines the mode of operation of refrigeration equipment, using standard tables, nomograms, diagrams	4	4
21 .5	Maintains the technological modes of operation of refrigeration systems with continuous control of the set parameters	4	4
21 .6	Participates in planned and emergency shutdown of refrigeration systems	4	4

Based on State Educational Standards for Professional direction 522 "Electrical engineering and power engineering"

Profession 522030 "Electrical equipment and installations technician" (IV EQF level)

Specialties:

- 5220308 "Renewable energy sources"
- 5220309 "Heat, air conditioning, ventilation and refrigeration"

Valid standard: State Educational Standard adopted with Ordinance № 2/04.02.2019.

Relevant occupations:

3115-3016 Mechanical technician, heating, refrigeration and ventilation installations;

3115-3020 Mechanical technician, nuclear heat energy;

3115-3039 Mechanical technician, air conditioning, ventilation and refrigeration technique;

3115-3043 Mechanical technician, air purifier;

3115-3046 Mechanical technician, thermal and hydropower machines;

3115-3051 Mechanical technician, district heating;

3131-3007 Operator, gas generator (gas generator);

3131-3010 Operator, steam turbines;

3131-3017 Operator, geothermal power plant;

3131-3020 Operator, steam generator (electricity generation);

3131-3021 Operator, solar power plant;

3131-3024 Operator, thermal power plant;

3131-3025 Operator, hydroelectric power plant;

3131-3029 Assistant Operator, steam turbine;

3131-3030 Assistant operator, steam generator;

3131-3006 Operator, water turbine;

3131-3009 Operator, district heating station;

3131-3016 Operator, gas power plant;

3131-3022 Operator, auxiliary facilities in the power plant;

3131-3026 Operator, nuclear reactor.

Comments: specific references to energy efficiency/RES/nZEB (among others):

ULO 25. Assembly and disassembly of equipment and installations for systems with RES

LO 25.1. Explains the principle of operation and design of facilities and installations for the production of electricity from renewable energy sources (solar, wind, geothermal and water energy, including energy from sea waves, tides)

LO 25.2. Explains the principle of operation and design of facilities and installations for the production of thermal energy from renewable sources (solar, geothermal energy, waste heat, biomass energy, industrial and municipal waste and hybrid systems)

LO 25.3. Installs / dismantles in accordance with the technical documentation equipment and installations for production of energy from renewable sources (wind generators, water turbines, biomass boilers, heat pumps, photovoltaic systems, solar heating installations and hybrid systems)

ULO 26. Diagnosis and repair of equipment and installations for production of electricity and heat from RES

LO 26.1. Explains the ways to detect and eliminate damage in systems with RES

LO 26.2. Performs technical inspection of equipment and installations for production of energy from renewable sources (wind generators, water turbines, biomass boilers, heat pumps, photovoltaic systems, solar heating installations and hybrid systems)

LO 26.3. Organizes repair operations by performing technical control according to technological requirements

ULO 27. Operation of facilities and installations for renewable energy systems

LO 27.1. Participates in a team in conducting tests and a 72-hour test of equipment and installations

LO 27.2. Applies the roles for conducting prevention in accordance with the technological documentation

LO 27.3. Supports the technological modes of operation of renewable energy systems and hybrid systems (wind turbines, water turbines, photovoltaic systems, solar thermal installations, biomass boilers, biogas and heat pumps)

LO 27.4. Participates in planned and emergency shutdown of equipment and installations of systems with RES and hybrid systems

LO 27.5. Uses specialized software programs in the activities for operation of RES systems, including hybrid systems

ULO 28. Principles of the "Passive House" standard

LO 28.1. Explains the application of European directives in national energy efficiency programs and regulations

LO 28.2. Analyzes the thermal characteristics of the building envelope of the existing building stock

LO 28.3. Systematizes facilities and installations by energy classes

LO 28.4. Offers innovative solutions for the introduction of renewable energy installations in the design of buildings with almost zero energy consumption

522040 "Electrical equipment and installations installer" (III EQF level)

Specialties:

- 5220408 "Renewable energy sources"
- 5220409 "Heat, air conditioning, ventilation and refrigeration"

Valid standard: State Educational Requirement adopted with Ordinance № 41 / 09.01.2012.

Relevant occupations:

7124-2006 Worker, insulation of refrigeration and air conditioning systems,

7124-2007 Worker, repair of thermal insulation,

7233-2004 Boilermaker, repair of power units and equipment,

7233-2009 Mechanic, industrial equipment,

7233-2011 Installer, installation of industrial equipment,

7233-2029 Installer, hydropower equipment,

7233-2030 Installer, maintenance of installations and equipment,

3131-3021 Operator, solar power plant,

3131-3020 Operator, steam generator (electricity generation),

3131-3025 Operator, hydroelectric power plant

Comment: No reference to nZEB or energy efficiency in general. The deficiencies could be partially overcome through interventions in the respective plans and programmes, however it is recommended to adopt a new standard reflecting the improvements in the standard for EQF level IV described above.

APPENDIX B5

No	Table 4: Country specific learning outcome and qualifications		
	Building services design roles HVAC and energy design (HVAC+E), Automation Engineer (AE), RES Engineer (RESE), Energy Auditor (EA)	HVAC+E	EA
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**		
1.1	Navigate the challenge of providing the needs of the energy consumers, while preserving the natural environment and the valuable resources of the Earth, by providing contemporary, efficient and environmentally friendly solutions.	7	7
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**		
2.1	Familiarizing with the concepts of sustainable energy development, integrated sustainable building design and nearly zero-energy buildings, as well as with the corresponding approaches, methods and standards in the field of energy efficiency.	7	7
2.2	Has knowledge on the energy characteristics and the energy efficiency in buildings and industrial systems, the systems for ensuring the microclimate in the living environment	7	7
2.3	Has knowledge on theories, concepts, principles and regularities for the efficient systems for utilization of the energy resources, such as combined systems for production of heat, cold and electricity, various active and passive solar systems, highly efficient heat and cold generators, modern materials and control systems of thermal processes	7	7
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**		
3.1	Use analytical and numerical methods, applicable for the design, modelling and analysis of energy conversion technologies and systems	7	7
3.2	Know about the impact of energy consumption on the environment and the ways to reduce the harmful effect thereof	7	7
3.3	Know about modern approaches, methods, techniques and algorithms for processing and analysis of data sets for technical, energy and ecological characteristics of the heat engineering systems, their constituent elements, the regime parameters and the parameters of the external and internal environment	7	7
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**		

4.1	Be familiar with applications, technical and energy performance characteristics, and methods for analyzing the energy and cost efficiency of specific energy conversion technologies and systems, particularly those used in buildings and industrial plants	7	7
4.2	expand and deepen your knowledge of the available heating and refrigeration technologies and systems and their applications in buildings, industrial facilities, the cold chain, and all branches of the economy.	7	7
4.3	Employ active and passive methods for utilization of renewable energy sources	7	7
...			
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**		
5.1	Gain new knowledge and skills related to the design, development, control, diagnostics, modelling and analysis of heating and refrigeration systems, utilizing conventional and renewable energy sources.	7	7
5.2	Get acquainted with different approaches for energy modelling and simulation, technical and economic evaluation, and comparative analysis of energy conversion technologies and systems.	7	7
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**		
6.1	Has the skills for independent development and design of heat engineering systems and facilities	7	7
6.2	Has the skills to conducting theoretical and experimental research, summarizing and analyzing the results	7	7
6.3	Has the skills to perform expert activities in the field of heat engineering, refrigeration equipment, heat supply and gas supply, utilization of energy from renewable sources.	7	7
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**		
7.1	1Nature and possibilities of model analysis of buildings. Engineering principles for determining heating areas in a building. Fundamentals and features of the software for model analysis of the energy consumption of buildings.		7
7.2	Approach and features in creating models of energy consumption of buildings for the heating period. Modeling of energy consumption and the mutual influence of heating and ventilation systems in buildings with one and more than one heating areas. Variants and concepts of models, evaluation of models.		7
7.3	Approach and features in creating models of energy consumption of buildings for the cooling period. Models for estimating energy consumption in combined operation of cooling systems. Variants and concepts of models, evaluation of models.		7
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**		
8.1	N/A		

Based on:

<u>Energy Conversion Technologies and Energy Efficiency in Buildings and Industrial Plants</u>

All residential, retail, public, commercial and other buildings, data centers, transportation vehicles, logistics centers, industrial plants and many other facilities require heating and refrigeration technologies and systems to maintain a healthy and comfortable indoor environment, provide specific environmental conditions, or carry out industrial processes. Therefore, these technologies consume vast amounts of energy worldwide and the provision of energy efficient, environmentally friendly and cost-efficient solutions for them is a key element of sustainable energy development. The Master's program in Energy Conversion Technologies and Energy Efficiency in Buildings and Industrial Plants will prepare you to become highly qualified professionals, capable of developing, analyzing, evaluating and applying such solutions.

If you choose the Master's program in Energy Conversion Technologies and Energy Efficiency in Buildings and Industrial Plants:

- You will expand and deepen your knowledge of the available heating and refrigeration technologies and systems and their applications in buildings, industrial facilities, the cold chain, and all branches of the economy.
- You will learn various active and passive methods for utilization of renewable energy sources.
- You will gain new knowledge and skills, pertaining to the design, development, control, diagnostics, modelling and analysis of heating and refrigeration systems, utilizing conventional and renewable energy sources.
- You will get acquainted with different approaches for energy modelling and simulation, technical and economic evaluation, and comparative analysis of energy conversion technologies and systems.
- You will become familiar with the concepts of sustainable energy development, integrated sustainable building design and nearly zero-energy buildings, as well as with the corresponding approaches, methods and standards in the field of energy efficiency.
- You will learn how to navigate the challenge of providing the needs of the energy consumers, while preserving the natural environment and the valuable resources of the Earth, by providing contemporary, efficient and environmentally friendly solutions.

The curriculum includes three main components:

- In the courses on Applied Mathematics, Applied Fluid Mechanics, Thermodynamic Analyses, and Modelling and Control of Thermal Processes you will study various analytical and numerical methods, applicable for the design, modelling and analysis of energy conversion technologies and systems;
- In the courses on Renewable Energy Utilization Systems, HVAC Systems in Buildings, Energy Performance of Buildings, Chilling and Freezing, Industrial Thermal Systems, Purification of Air and Gases, and Gas Supply Systems you will study the applications, technical and energy performance characteristics, and methods for analyzing the energy and cost efficiency of specific energy conversion technologies and systems, particularly those used in buildings and industrial plants;
- At the end of the program you will develop a diploma thesis, under the supervision of a faculty advisor.

Related occupations:

- Design, engineering, consulting and retail companies, specialized in heating and refrigeration technologies and systems, and in the field of energy efficiency, including:

    - Design and development firms, departments, bureaus, workshops and laboratories;
    - Consulting and retail companies in the field of HVAC/R systems;
    - Companies, departments and units engaged in operation and maintenance of HVAC/R systems;
    - Consulting companies specialized in energy efficiency assessment of buildings and industrial systems;
    - Local commercial representation offices of foreign companies in the field of energy engineering.
- Energy production and distribution enterprises, including power plants and other energy generation facilities, utilizing conventional and renewable energy sources, as well as district heat supply and gas supply companies.
- Manufacturing and other companies in the food production, chemical, biotechnological, and textile industries, as well as building construction, transport, agriculture, and ecology.
- Companies manufacturing components for heating, ventilation, refrigeration, air conditioning and other energy conversion systems.
- All companies operating in the cold chain – from production, storage and transportation to the consumers of chilled and frozen products.
- Research and development centers and laboratories in the field of energy engineering.
- National and international institutions in the field of energy efficiency and sustainable energy development.

ORDINANCE on the state requirements for acquiring higher education of educational qualification degree "master" in specialties of the regulated profession "Investment Design Engineer"

The persons, who have successfully completed the training, receive the professional qualification "energy engineer".

The training ensures the acquisition of knowledge for:

1. the energy characteristics and the energy efficiency in buildings and industrial systems, the systems for ensuring the microclimate in the living environment;
2. theories, concepts, principles and regularities for the efficient systems for utilization of the energy resources, such as combined systems for production of heat, cold and electricity, various active and passive solar systems, highly efficient heat and cold generators, modern materials and control systems of thermal processes;
3. the impact of energy consumption on the environment and the ways to reduce the harmful effect thereof;
4. modern approaches, methods, techniques and algorithms for processing and analysis of data sets for technical, energy and ecological characteristics of the heat engineering systems, their constituent elements, the regime parameters and the parameters of the external and internal environment.

The training ensures the acquisition of skills for:

1. independent development and design of heat engineering systems and facilities;
2. conducting theoretical and experimental research, summarizing and analyzing the results;
3. performance of expert activity in the field of heat engineering, refrigeration equipment, heat supply and gas supply, utilization of energy from renewable sources.

The training shall ensure the acquisition of competencies for:

1. initiative and creativity in organizing and managing the process of design and evaluation of the technical, economic and ecological efficiency of heat engineering systems;
2. participation in processes of integrated planning and design;
3. collection, classification, evaluation and interpretation of data for the purpose of solving specific tasks and preparation of technical documentation;
4. work with European and national standards, national applications and norms, public policies and market instruments;
5. integration of interdisciplinary knowledge in solving specific tasks;
6. formulation and presentation of ideas, cases and solutions;
7. initiating changes in the management of processes in conditions of uncertainty;
8. formulation and making of effective decisions, as well as determination of the appropriate for each case techniques and algorithms;
9. assessment of the need to increase their own professional qualification and additional training of the team.

ORDINANCE № RD-16-301 of 10.03.2014 on the circumstances subject to entry in the registers of the persons performing certification and energy efficiency audits of buildings and industrial systems, the procedure for obtaining information from the registers, the conditions and the order for acquiring qualification and the necessary technical means to carry out the activities on inspection and certification

Module 1: Energy efficiency audit and certification of buildings (certification course programme)

1.1. Structure, development and comparative framework of the European and Bulgarian legislation on energy efficiency. Succession and specific requirements of the regulatory framework for energy efficiency. Legally binding norms of laws and regulations in the field of energy efficiency.

1.2. Nomenclature of types of buildings in Bulgaria. Construction systems, practices and trends in building construction. Evaluation of the efficiency of the systems in the context of energy consumption in buildings. Features of the enclosing structures, identification of the data sources. Features and techniques in surveying and measuring geometric characteristics for the purposes of the energy efficiency survey. Applicable technical standards.

1.3. Essential requirements to the buildings, normative provision for their application and control over their implementation in the buildings. Concept of "life cycle" and "intended use" of building

construction products. Essential characteristics of construction products for enclosing structures that are directly related to the requirement for energy efficiency of buildings.
1.4. Principles of heat transfer. Heat transfer through building elements. Features of the heat transfer coefficient (U-value, W / m 2 K) at various structural elements of the building. Reference sources for calculation and / or reporting of U-values.
1.5. Thermal bridges. Ways to determine heat loss through enclosing elements with thermal bridges
1.6 Measurement of hydraulic, thermal and electrical quantities; energy consumption, solid, liquid and gaseous substances.
1.7. Stages, content and features of the survey for energy efficiency of buildings. Reference data sources, systematization and documentation of the source data and results. Sensitivity analysis of the results. Modern technical means for measuring during the inspection for energy efficiency of buildings. Measurement control points. Integration and analysis of results. Measurement documentation.
1.8. Method BDS EN ISO 13790 for determination of annual energy consumption in buildings. Specific definitions and concepts. Heat losses and gains. Energy balance of a building. Components of heat and energy balance system connections, mutual influence and combination of heat flow components. Concept of optimality in terms of energy costs.
1.9. Nature and possibilities of model analysis of buildings. Engineering principles for determining heating areas in a building. Fundamentals and features of the software for model analysis of the energy consumption of buildings.
1.10. Approach and features in creating models of energy consumption of buildings for the heating period. Modeling of energy consumption and the mutual influence of heating and ventilation systems in buildings with one and more than one heating areas. Variants and concepts of models, evaluation of models.
1.11. Approach and features in creating models of energy consumption of buildings for the cooling period. Models for estimating energy consumption in combined operation of cooling systems. Variants and concepts of models, evaluation of models.
1.12. Assessment of the effect of single energy saving measures. An iterative process for evaluating the effectiveness of a package of energy saving measures. Compatibility of energy saving measures with the basic (essential) requirements for buildings.
1.13. Principles and rules for energy efficiency in the main groups of subsystems on the building:
1.13.1. Fuels. Hot water boilers using conventional energy resources. Boilers burning biomass. Seasonal efficiency of boilers. Evaluation of the efficiency of local heating with fireplaces and individual heating appliances with combustion of solid, liquid and gaseous fuels. Applicable norms, rules and technical specifications.
1.13.2. Gas supply to public service buildings. Efficiency of systems in the context of technology development.
1.13.3. Units for combined heat and power generation
1.13.3a. District heating substations for heating and hot water for domestic needs. Regulation of thermal processes. Characteristics of regulators. Heat distribution in buildings. Heat distribution and measurement for hot water supply.

1.13.4. Energy efficiency of pumps and fans. Factors affecting efficiency.

1.13.5. Assessment of the possibilities for energy efficiency of heating systems, implemented according to classical schemes. Efficient technologies of heating systems with conventional heat source. Evaluation of the efficiency of the systems in energy saving measures, providing different levels of thermal comfort in the buildings. Specific requirements in the relevant national legislation, European standards and norms.

1.13.6. Renewable energy source systems for heating, air conditioning or ventilation of buildings. Heat pumps. Modern air conditioning systems for public service buildings. Systems for specific purpose buildings. Requirements in the relevant national legislation, European standards and norms

1.13.7. Solar energy recovery systems.

• Active solar systems for heat generation. Applicable schemes of domestic water heating systems in buildings with central heating systems. Method for estimating the possible share of solar energy. Market conditions and current elements and equipment for installations in buildings.

• Active solar systems for cooling. Types and indicators of effectiveness.

• Active solar systems for production of electricity. Method for estimating the amount of electricity produced from solar energy. Market conditions and current elements and equipment for installations in buildings.

1.13.8. Cooling and freezing systems. Types by functional purpose. Indicators for evaluating the efficiency of the systems.

1.13.9. Systems for electrical equipment and power supply in public buildings service. Specific requirements in the relevant national legislation, European standards and norms.

1.13.10. Modern lighting systems. Evaluation of the efficiency and energy consumption in the combined action of active artificial lighting systems and systems for increased use of daylight. Performance indicators of lighting systems in buildings. Specific requirements in the relevant national legislation, European standards and norms.

1.14. Efficiency of appliances consuming electricity in buildings. Requirements in relevant national and European legislation, European standards and norms.

1.15. Modern technologies and systems for monitoring, control and management of energy consumption in public service buildings. Requirements in the relevant national legislation, European standards and norms.

1.16. Passive buildings and NZEBs. Connections and differences of concepts. National legislation, European standards and norms.

1 .17. Assessment of the economic feasibility of energy saving measures. Indicators of economic feasibility. Specialized software for and economic evaluation of energy saving measures.

1.18. Certificate for energy performance of a building. Types of certificates, regulations and conditions for certification.

1.19. Report on the results of the inspection of hot water boilers. Report on the results of the inspection of air conditioning systems.

2. Module 2: Assessment of compliance of investment projects of buildings with the requirement for energy efficiency.

2.1. Normative rules and procedure for performing the conformity assessment, scope and content of the checks for conformity of the values of the energy consumption indicators. Documentation of the conformity assessment under Ordinance № 7 for energy efficiency, heat storage and energy saving in buildings.
3. Module 3: Preparation of estimates for energy savings.
3.1. Legislatively applicable methods, rules and procedures, documentation and administration of the process of estimating energy savings in buildings.
4. Module 4: Development of a course project.
4.1. Energy efficiency audit of a public service building with a heating and cooling requirement. Documenting the process by the energy efficiency consultant (preparation of a report and summary of the inspection, issuance of a building certificate).

Additional related specialties

Specialty "Energy saving control systems"

The limitations of the contemporary energy sources imply the necessity of energy efficient use, transformation, transport, consumption and control of processes, plants, technologies and production systems in the material and nonmaterial industrial applications. Significant part of the current scientific issues connected with: minimization of the consumed energy, energy transformation and use of new energy sources. All these are solvable through strategies, principles, methods and algorithms of energy efficient control.
Automation is a core element in all industrial engineering applications. It is a fundamental prerequisite for all students in acquiring knowledge and skills in different areas of the contemporary engineering sciences. In this very connection, during their education in ESCS master course, students will acquire knowledge in the areas of:

• Automatic control systems;
• Modelling of Technical and Economic Systems;
• Robust Energy Saving Control of Plants and Systems;
• Intelligent energy-efficient control and processing of information;
• Communication networks and standards in industry;
• Converters in Electromechanical Systems and Electric Drives Automation;
• Energy-saving control in electromechanics and building automation;
• Renewable energy sources and energy saving electric drives;
• Energy Efficient Robots;
• Computer modeling, synthesis and optimization of electro technical systems and devices;
• Computer Control Systems;
• Process Control in Power Engineering.

Competences:

The graduates in ESCS should be qualified in:

• Research, design, implementation of control systems, metrology, management activities in solving different automation problems and energy efficient control in industrial applications – energy production, transport systems, chemistry, metallurgy, pharmacology, HVAC systems etc., as well as in the nonindustrial applications – banking, health care, communications, administration in the public sector, education, health services, ecology, defense, security, tourism etc.
• Formulate and specify tasks in the field of automation and control in meaning of energy efficiency and implementing contemporary and low cost technical, programing and organizational techniques.
• Manage teams of professionals in different areas of automation and energy efficient control.

Related occupations
• Scientific and design groups, engineering and consulting companies as well as companies implementing complex technical, economic and organizational systems for energy efficient control of industrial automation technologies, building automation, HVAC systems, etc.;
• Management and support groups in the industry, energy production, transport, construction, and different areas of the nonproduction fields;
• Metrology groups, industrial plants, companies for automation and quality control;
• Engineering companies for design, production and implementation of control systems, programmable machine and systems, mechanisms, robotic systems;
• Food industry, pharmacology, chemical industry, metallurgy, health care, transportation systems, new energy sources and ecology.

Specialty "Technologies for utilization of renewable energy sources"
This master's degree program focuses on the energy conversion technologies and systems used for transforming the primary energy of renewable sources (solar, wind, hydro, biomass, and geothermal energy) into useful energy for the final consumers (mechanical energy, electricity, heat and cold). The curriculum encompasses technologies and systems of varying purpose, scale, and principle of operation, including:

- Centralized and distributed power generation systems (e.g., concentrated solar power plants, photovoltaic systems, wind parks, hydroelectric plants, and geothermal power plants);
- Combined heat, cold and power (cogeneration and trigeneration) systems driven by solar energy, geothermal energy, or different types of primary biomass and their derivatives (e.g., wood pellets, liquid biofuels, and biogas) – used for both centralized energy generation (i.e., combined heat and power plants providing district heating) and distributed energy generation (i.e., local cogeneration and trigeneration systems for individual buildings, groups of buildings, or industrial sites);
- Active and passive systems for heating and cooling of buildings utilizing solar, biomass, or geothermal energy;
- Hot water production systems for buildings, pools, or industrial processes driven by solar or geothermal energy;

The curriculum further encompasses the integration of renewable energy sources (RES) in the electric grid and in end-user energy systems, as well as the pertinent regulatory framework. Also covered are

the adopted international treaties, European and national policies, and various policy instruments aimed at promoting the use of renewable energy and sustainable energy development.
The curriculum is structured as follows:

- **Module 1** (Fundamentals): The first part of the curriculum includes three compulsory courses via which the students gain basic knowledge in thermodynamics, heat transfer, and fluid mechanics, as well as an introduction to the national and global energy resources, the overall energy system, and the trends in its development. In the first two courses (Thermodynamics and Heat Transfer; Fluid Mechanics and Fluid Technology) the students learn the fundamental concepts and physical laws in energy engineering, the fundamentals of the energy conversion processes and technologies, and the basics of the methods for their analysis. The students get acquainted with the basic devices and elements composing the energy conversion systems. In the third course (Energy Resources and Sustainable Energy Development) the students learn about the available resources of fossil fuels, the technologies used for extracting and utilizing them, the ecological and economic aspects of conventional energy production, as well as the overall trend of development of the energy sector, the concepts and strategies for sustainable energy development.
- **Module 2** (Specialized subjects): This module includes six compulsory and two elective courses focusing on the technologies and systems for utilization of solar, geothermal, hydro, wind, and biomass energy. These courses are intended for accumulation of solid knowledge and skills related to: (1) analysis and evaluation of the available potential of the studies renewable energy sources (RES); (2) the various possibilities, technologies and systems for converting the energy of the renewable sources into mechanical work, electricity, heat and cold; (3) the specifics of energy conversion of the studied renewable source and the environmental impact of the corresponding energy conversion processes; (4) the integration of RES in the electric grid and in end-user energy systems; (5) the European policies and the regulatory framework pertinent to the integration and operation of renewable energy technologies.
- **Module 3** (Diploma thesis): Each student develops a master's thesis, applying the knowledge and skills acquired through the master's degree program.

Related occupations

The graduates of this master's degree program can find employment and develop their careers in a range of organizations, enterprises, and institutions from the private and public sectors which are engaged in:

- Analysis and evaluation of the potential for utilization of solar, wind, hydro, biomass, and geothermal energy;
- Analysis and evaluation of the technical, economic and environmental performance of the technologies for utilization of the aforementioned renewable energy sources (RES);
- Application of specialized software for optimization of the operational parameters of RES utilization systems;
- Application of specialized methods and software for energy modeling and simulation;
- Consulting services and project management in the field of renewable energy;
- Integration and operation of RES utilization systems;

- Research and development in the field of renewable energy;
- Development and implementation of renewable energy policies;
- Advertising and retail activities related to RES utilization technologies and their integration in the electric grid and in end-user energy systems;

Examples of such organizations, enterprises, and institutions are:

- Companies specialized in manufacturing components for RES utilization systems or engaged in installation, operation, and maintenance of such systems;
- Retail companies supplying components and equipment for RES utilization systems in the energy production, industrial, agricultural, and domestic sectors;
- Consulting firms providing analyses in the fields of energy efficiency and renewable energy technologies;
- Research and development centers and laboratories specialized in renewable energy;
- All other organizations, bureaus and companies dealing with renewable energy technologies;
- Non-governmental organizations aimed at promoting sustainable energy development;
- Government agencies and administrative structures at the national, regional, and local level, as well as other national and international institutions engaged in the fields of energy production, energy efficiency, and sustainable energy development.

APPENDIX B6

No	Table 3: Country specific learning outcome and qualitfications	EQF Level		
	Structural design roles Structural engineering design Magister (SED), Construction Management (Bachelor), Project Management in Construction (Master)	SED	CM	PMC
LO1	**Learner is able to explain the fundamentals of energy interventions and the underlying principles of uses with respect to building life-cycle.**			
1.1	Recall essential contents, summarize and give examples of energy interventions terminologies, definitions and standards.	4	4	5
1.2	Explain added value of sustainable energy efficient practices and sustainable projects.	3	4	5
1.3	Explain the potentials of different energy-compatible assessment, simulation and optimization tools in achieving good energy and building performance.	3	4	5
1.4	Summarize the ideas of digital space and asset management.	2	2	2
1.5	Explain the added value of using energy model open file formats to ensure interoperability.	2	2	2

1.6	Explain the main contents and apply relevant parts of national energy guidelines.	3	3	4
LO2	**Learner is able to explain the fundamentals of energy sustainability and energy-efficient buildings and building performance.**			
2.1	Explain and give examples of aspects and terminology related to energy interventions and building energy performance.	4	5	6
2.2	Describe the aspects (financial and environmental) and energy related indicators and building performance.	4	5	6
2.3	Explain relations between life-cycle costs, energy performance and building performance.	5	5	6
2.4	Summarize and illustrate the potentials of renewable energy sources including district-scale solutions.	4	4	5
2.5	List and explain the core concepts of sustainable energy building rating and certification systems.	3	3	4
LO3	**Learner is able to prepare energy efficiency execution plan and explain essential aspects in setting strategic and project based energy targets.**			
3.1	Explain the overall design process for energy-efficient building.	3	4	5
3.2	Assist client to set realistic and achievable energy and building performance target.	3	4	5
3.3	Perform preliminary energy analysis in the early project stages for both new and renovation projects to add value for the decision making.	4	4	5
3.4	Assist the client to set and specify information requirements.	4	4	5
3.5	Explain how to support owner's effective decision-making and opinion formation of other stakeholders.	4	4	5
3.6	Illustrate how to direct the design towards set targets utilizing the capacity of different kinds of assessment methods relevant for building construction design.	5	5	6
3.7	Explain the flow of design teamwork and demonstrate how to prepare, compare and improve alternative concepts.	5	5	6
3.8	Lead / assist the tasks related to technical documents for the building authorities.	6	5	6
LO4	**Learner is able to explain about the procedures and importance of setting energy targets for sustainability and building performance.**			
4.1	Apply the set performance targets related to building design into BIM-based design process.	4	4	4
4.2	Iterate the design solutions to meet the set targets of building performance and energy efficiency.	4	4	4
4.3	Consider options of renewable energy and optimize its potentials.	3	3	4
4.4	Create different energy efficient design concepts renewable energy systems.	3	4	4
4.5	Perform energy analyses including dynamic simulations.	2	2	2

4.6	Perform analyses of indoor air conditions with CFD (computational fluid dynamics), temperature conditions, comfort level, air quality, velocity, humidity and carbon dioxide level.	2	2	2
4.7	Perform lightning calculations, analyses and simulations.	2	2	2
4.8	Discuss and assess the effect of main building materials and main product type selections on energy performance and building performance and prepare alternative potential solutions to fulfil the set targets.	4	5	5
4.9	Use life cycle cost calculation including life-cycle studies changing influential design parameters.	5	4	5
4.10	Share the results of energy simulations, discuss the options and update domain BIMs.	4	3	4
LO5	**Learner is able to explain and use energy based collaboration methods for energy management and processes.**			
5.1	Prepare the Construction engineer's domain model on the basis of set targets and definitions given in architect's domain model.	6	3	4
5.2	Create and update digital (BIM-linked) building specification with material and dimensional information to reflect owner's quality and performance requirements.	4	3	4
5.3	Explain essential issues of the needs of initial information and the potentials of different inventory surveys in refurbishment projects.	5	4	5
5.4	Support the process resulting in the publication of the merged model (As-Designed) together with all needed information.	4	4	4
5.5	Prepare/assist information needed for specific use cases such as bill of quantities.	6	5	6
5.6	Prepare/assist the domain model for simulation and assessment.	5	4	5
5.7	Prepare/assist models and information for planning authority and in required data format.	4	3	4
5.8	Prepare/assist models and information for procurement and construction.	5	4	5
5.9	Prepare models to fulfil quality and information requirements for quality control and assurance processes in construction.	5	4	5
5.10	Prepare models based on data and information requirements of sustainable care and maintenance processes.	4	4	5
5.11	Prepare information for As-Built Models and Maintenance model for utilization of client and building management.	4	4	5
5.12	Prepare/assist in the digital formulation of care maintenance instructions (maintenance manual) reflecting owner's energy and performance requirements.	5	4	5
LO6	**Learner is able to explain, implement and supervise quality compliant energy management procedures in building project to achieve set targets.**			
6.1	Describe the essential parts of the procedure for BIM based collaboration.	4	4	5
6.2	Describe different collaborative interdisciplinary and open BIM working methods, tools and processes.	4	4	5

6.3	Demonstrate how to work collaboratively with the project stakeholders including the design team, client, users, manufacturers, construction site and building authorities.	4	4	5
6.4	Prepare relevant visualization models to enable information sharing, decision making and opinion formation.	5	4	5
6.5	Demonstrate the flow of design teamwork with use of void provision model together with architectural and structural design.	6	5	6
6.6	Collaborate with the help of communication platforms and processes.	6	5	6
LO7	**Learner is able to use different relevant energy software and interfaces between relevant software.**			
7.1	Assist / participate in systematic modelling in own organization ensuring that all information is provided in right order, right format and on agreed schedule.	4	3	4
7.2	Validate and check compatibility of the domain model and manage and repair conflict.	4	3	4
7.3	Verify the achievement of the targets on the basis of the results received with the help of different kinds of assessment methods relevant for building construction design.	5	3	4
7.4	Participate in the verification of the achievement of the targeted result and undertake site inspections in construction site.	5	4	5
7.5	Comment product and system providers' designs and comment the contractor's equipment selection impacts on energy consumption to ensure the fulfillment of targets.	4	3	4
7.6	Instruct and audit contractors on construction site on critical points.	6	4	5
7.7	Describe and assess quality assurance methods for energy-efficient building solutions to verify achievement of set targets.	4	3	4
LO8	**Learner is able to use different energy tools for solving complex problems at the interface between domains (i.e. energy-water nexus)**			
8.1	Use domain specific BIM authoring applications for building construction design and analysis.	6	4	4
8.2	Use relevant energy design calculations and assessment tools in different design phases.	2	3	3
8.3	Use different tools for BIM-based collaborative working.	5	4	5
8.4	Create combination model and use model checking tools for clash detection.	4	3	4
8.5	Extract energy information from BIM (MEP, ARCH and Structural model in different LOD-phases) to BEM for simulations and import results back to BIM.	3	3	4
8.6	Use relevant visualization tools for visualizing design solutions and output from energy simulations, calculations.	5	3	4
8.7	Prepare the domain model for simulation and assessments	4	3	4
8.8	Use tools for environmental impact analyses.	3	3	4

8.9	Use project data and file management systems.	5	4	5

Sources:

1) Elective course "Increasing resource and energy efficiency in construction" in the 4th year of “Construction of buildings and facilities“ (Civil Engineering Faculty) - 30 hours of lectures and in the master's program "Project Management in Construction" (Civil Engineering Faculty).
2) Elective course "Management of energy-efficient renovation of buildings" in 5th year „Construction of Buildings and Facilities“ (Civil Engineering Faculty) and Architecture (AF) - 30 hours of lectures, implemented under the European project "Innovative training schemes for retrofitting to nZEB-levels - Fit to nZEB ”(see below).
3) Regular course "Energy Efficiency" in the bachelor's program "Management in Construction" in Civil Engineering Faculty, 3rd year - 30 hours of lectures and 30 hours of exercises.
4) Regular course "Building Materials" 2nd year “Construction of buildings and facilities“ - 75 hours of lectures and 60 hours of exercises.
5) Regular course in Civil Engineering Faculty "Building Insulations" 4th year “Construction of buildings and facilities“ - 30 hours of lectures and 45 hours of exercises.
6) Elective course "Advanced building materials" 3rd year “Construction of buildings and facilities“ - 30 hours of lectures.
7) Elective course "Construction Waste Management" in the master's program "Construction Project Management" (Civil Engineering Faculty), 30 hours of lectures and 15 hours of exercises.
8) Regular course "Building Physics" in the bachelor's program "Management in Construction" in Civil Engineering Faculty, 1st year - 30 hours of lectures and 30 hours of exercises.
9) Regular course "Organization and management of investment processes" in the bachelor's program "Construction Management" in Civil Engineering Faculty, 3rd year - 60 hours of lectures and 90 hours of exercises.
10) Regular course "Project Management Information Systems" in the bachelor's program "Construction Management" in Civil Engineering Faculty, 3rd year - 30 hours of lectures and 45 hours of exercises.
11) Regular course "Environmental protection and sustainable development" in the bachelor's program "Construction Management" in Civil Engineering Faculty, 3rd year - 30 hours of lectures and 15 hours of exercises.
12) Regular course "Digital project management in construction" in the master's program "Project management in construction" (Civil Engineering Faculty), 60 hours of lectures and 60 hours of exercises.
13) Regular course "Construction Information Modeling (BIM)" in the master's program "Project Management in Construction" (Civil Engineering Faculty) and in the specialty “Construction of buildings and facilities“, 30 hours of lectures and 30 hours of exercises.
14) Elective course "Sustainable Architecture" in the master's program "Project Management in Construction" (Civil Engineering Faculty), 30 hours of lectures and 15 hours of exercises.
15) Regular course "Management of infrastructure projects and environmental protection" in the master's program "Project management in construction" (Civil Engineering Faculty), 30 hours of lectures and 30 hours of exercises.
16) Regular course "Organization and management of construction" in the specialty “Construction of buildings and facilities“, 4th year, 45 hours of lectures

17) Regular course "Project in organization and management of construction" in the specialty “Construction of buildings and facilities“, 4th year, 45 hours of exercises

12. Appendix B

12.1 North EU Demo

12.1.1 Finland – RIL

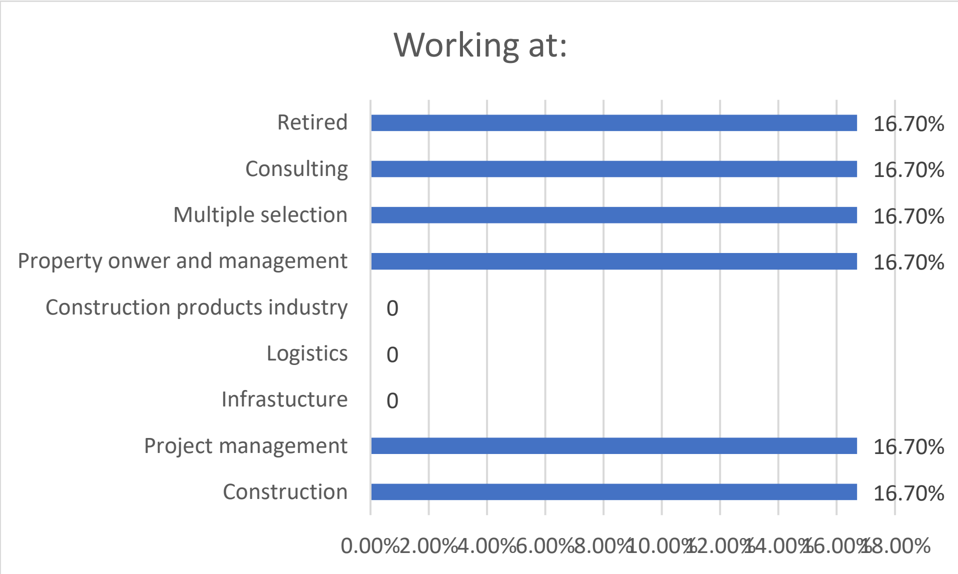
RIL's survey for the EU's INSTRUCT project: Insights into the development and status of energy efficiency?

RIL's survey for the EU's INSTRUCT project - background information

All survey participants are RIL (Finnish Association of Civil Engineers') member

I am working full-time 67%, part time or retired 33%

I'm working at the moment on the:



INSTRUCT survey: Insights into the development and status of energy efficiency?

Do you face any skill gaps in the delivery of energy-efficient and sustainable interventions? (All defendants)

Yes, it has been very difficult to find solutions to optimize the energy usage based for example on the electricity Spot - prises and delivery from solar panels.

Well

Well. The opposite. There have been for many years methods and technology to make energy use more efficient, but "customers" have not seen it profitable enough to make better use of these. Meaning they have not valued it enough to buy, because of "low" energy prices. It has not been a big advantage for businesses. Now the situation has changed dramatically.

Costs and Payback times are difficult to estimate at the moment

Currently, there are still gaps in goal setting and solutions RDI. Thus, gaps are inherent in these and everything that logically follows.

Use of new materials / techniques in renovation.

Can you elaborate on these skill gaps and the ways in which these are addressed on projects? (All defendants)

They are not well addressed, see above

Yes

We have access to a lot of data (energy usage, water consumption etc.) collected almost only for Charging purposes not for Guiding consumer's behavior . Now we need services for data platforms and ways to communicate directly and instantly to users. So that they could clearly see their actions' influence on consumption . And how they could save energy and money. For example: Water Charging once a year is not enough to get people to save water even though it is measured monthly.

The price level on the market varies and, for example, the latest technology of geothermal heat is a bit unclear

See my previous answer.

Are you satisfied with the training outcomes of your staff? (All defendants)

Yes

Yes

Yes.

Well, I haven't noticed very many educational events in this area

I can't say, yet. Our sector has to first determine training needs, then training aims, followed by training content.

Not always.

Have you relied on training to address these skill gaps by upskilling your staff? (All defendants)

- Yes
- Yes
- Well. Not only training. Sharing information and knowledge to each other regularly and following advancing of attitudes and skills .
- Well, in this area, our staff has not participated in training
- See my previous reply.
- Not in large scale .

What are the learning outcomes acquired by your staff which helped address the above skill gaps? (What are the skills (use of tools),

Knowledge (know-how of the content and theory), or autonomy/responsibility (ability to act at task level and apply skills and competence) (All defendants)

- Use of tools
- Open minded and curious attitude. Readiness to change.
- I cannot answer because there have been no such trainings
- See my previous replies.

Has the process of reducing energy skill gaps increased the profitability of your organization? (All defendants)

- Yes of course
- Yes
- Yes.
- I cannot answer because there have been no such trainings
- See my previous replies.
- There is some potential.

12.1.2 Finland - VTT

SKILLS
INSTRUCT
INSTRUMENTS
CONSTRUCTION

Stage 1: Engaging with the Local value chains
The questions that need discussing with each value chain (across the 5 demonstration projects) include:

1. What is your role in the project value chain?
   - How could you <u>enhance needed new skills or competence</u> at the project level on energy-efficient and sustainable interventions?
   - Do you feel <u>you have enough methods to require</u> skills and competence (like verifying skills during tendering or having a development phase in the procurement process)?
   - What type of <u>methods</u> do you know or have used?
   - Do you feel you need more <u>training on the requirements methods</u> for service providers about the skills and competence in energy-efficient and sustainable interventions?

Mr XXX
<u>My role</u>
I work as XXX
All education and training courses related to the built environment are under my supervision.

The School of Real Estate and Construction is in charge of the following degree programs: Civil Engineering (BEng and MEng), Construction Site Management (BEng), Construction Architecture (BArch), Building services engineering (BEng and MEng), Surveying engineering (BEng and MEng), Sustainable building engineering (BEng) and Construction and Real Estate Management (MEng).The number of students is ca 2000 and the school has 60 faculty members.

We have courses about The Green Transition and sustainable construction and Sustainable Development.
We offer a Professional Degree program called Building Service Systems. Content include HVAC and piping (plumbing). Further we educate energy performance related topics to student of electrical engineering.

Up-to-date content

In the energy issues technological equipment and their development is an important area, connected to primary energy sources or mix energy used in building for heating, electricity and cooling. One technology often used in energy renovations in Finland is the heat pump, because its effectivity to support heating in the winter and enabling cooling in the summer. To cover these kind of new innovations we use professionals and teachers to provide some lessons in our programmes. Also they have strong have practical skills to design. We educate digital design processes as they are widely used in building projects, BIM and the needed skills. We use MagiCAD which is the mostly common software in HVAC and MEP design.

Roles already adapted to the process

There are some roles which are already well adapted to the building process of advanced EE and low carbon buildings. For instance environmental specialist and energy expert are such roles and they have special responsibilities and tasks.
In the area of continuing education we offer courses for the environmental specialist of buildings. Some content: RTS environmental assessment framework, optimisation of carbon footprint, circular economy and demolition phase of the life cycle of buildings.

New roles appearing

More and more new know-how is needed as buildings become more complex. There is a strong tendency on-going where a group of experts, specialists and coordinators become a part of the main design team (Arch, Structural, MEP) on building projects. They support the design team and/or the client. We have for example Healthy building- coordinators, Clean building- consultant and coordinator for building physics and moisture management.
This is natural as the competence and capacity of one designer is limited, when new view points and focus areas are emerging. These topics will be part of

basic education in time, but first they are topics for continues education courses and professional seminars.

How to certify professionals

Voluntary competence building is working well in the Finnish business environment of construction sector. It's also agile. Dissemination of best practices is a good way to make the professional community and disciplines aware of needed new processes, quality levels, new solutions in the topics of indoor air quality, energy efficiency, climate aware design, new applications in software etc… In order to master the new approaches, which need new skills and knowledge the training is needed in some form. Here the training institutes (courses/ programmes) and associations (seminar days for professionals) have an important role.

Providing training need based - but also as business

Training and continues education courses are offered when they are meaningful as business. This means that there might be - hopefully a small - gap between the first need of know-how related to novel/ emerging approaches and courses, programs to full fill the need for competence building.

Content of the competence certifications and quality certifications of experts should be defined by the industry sector. In material quality certification their GHC emissions should be marked.

Competence verification

For our student and customers we use Competence Mark.

- we also pilot the use of MydataShare (by Vastuu Group https://www.vastuugroup.fi/fi-en/our-services)

Qualification register for energy designers (most likely FISE or similar organisation), is needed

2. Do you face any skill gaps in the delivery of energy-efficient and sustainable interventions?

   - Can you elaborate on these skill gaps and the ways in which these are addressed on projects? Examples…

Emerging contents

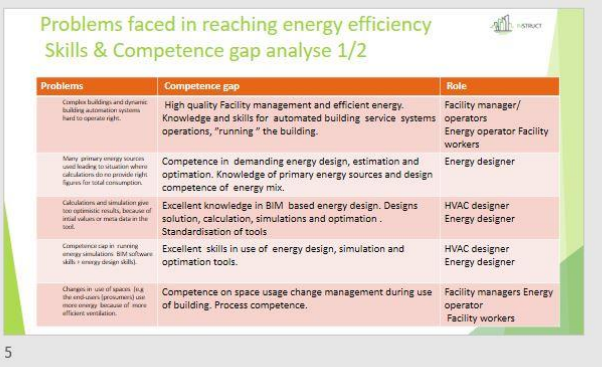
HVAC and MEP experts need overall understanding of the holistic energy performance as systems, but also the dependencies in collaboration, management etc. for achieving the targeted energy efficiency.
Dependences are many fold, for example to (1) other design disciplines (orientation, volume design (form factor), spatial design, structural and building design, quality levels of building materials, technical systems and equipment); to (2) procurement of technical systems and equipment; (3) to quality of construction work and assembly, especially airtightness.
Design know-how is required from the areas for example:

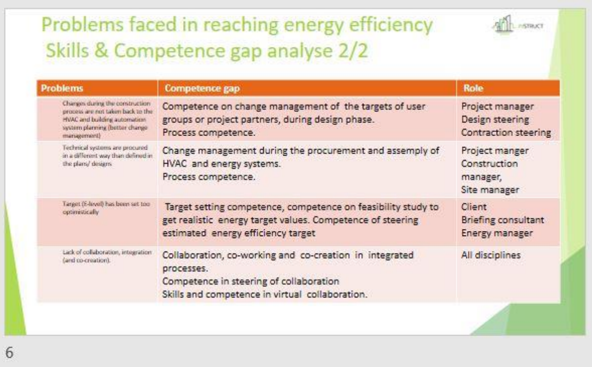
- Relation between actual use of energy and use level in calculations (based on industry level standards)
- Complexity of the technical energy systems and their adjustment rules (based on calculations).
- Back count calculations in the end of building project should be required more often, meaning:
  - repetition of IDA-ICE simulations
  - checking the usage groups and their behaviour profile
  - calibrating the system adjustment rules to real consumption rates

Energy simulation is expert work and the task need high level competence from energy designer/ expert. In order to “estimate” absolute energy consumption rates, very precise initial data is needed. Often in the design phase the initial date is not accurate (unknown users, behaviour profiles might be unclear)

**

3. Have you relied on <u>training</u> to address these skill gaps by upskilling your staff?
   - Are you satisfied with the training outcomes of your staff?
4. What are the <u>learning outcomes</u> acquired by your staff which helped address the above skill gaps?
   - What are the skills (use of tools), Knowledge (know-how of the content and theory), or autonomy/responsibility (ability to act at task level and apply skills and competence)
5. Has the process of reducing energy skill gaps <u>increased the profitability</u> of your organization?
   - On the same note, has the process of reducing energy skill gaps and energy skills <u>increased the added value</u> of your organization?





12.2 Central EU Demo

12.2. 1 Poland ASM

No contributions have been received.

12.3 West EU Demo

12.3.1 Luxembourg – LIST

INSTRUCT project. WP2

Interview of Interviewee 1 -BIM Trainer
What is your role in the project value chain?
Lionel provides trainings to all the defined roles in the matrix. The trainings handle introduction to BIM and how to interact with the BIM model. A complete list of BIM trainings in Luxembourg is available[12], the "BIM basics"[13] and "BIM referent"[14] trainings are those where Lionel is involved. So, the role in the value chain is raising skills of project stakeholders. The skills are related to the use and understanding of a BIM model. BIM is considered as a tool to perform better projects; it is not an end in itself.

1. Do you face any skill gaps in the delivery of energy-efficient and sustainable interventions?

For the interviewee, the BIM trainings and tools are available (even if they could be improved) **but there is no willingness to use BIM as yet for this purpose in a complete project.** So, the

[12] https://www.digitalbuilding.lu/formation/autres-formations/
[13] https://www.digitalbuilding.lu/formation/bim-bases/
[14] https://www.digitalbuilding.lu/formation/bim-referent/

competences/skills from stakeholders are not high enough because of a lack of demand of projects requiring complete BIM integration.

2. Can you elaborate on these skill gaps and the ways in which these are addressed on projects?

Let's focus on the link between BIM and energy efficiency/sustainability. Basically, the use of a BIM models could allow to have an impact on energy performance analysis (compute directly energy consumption in the actual project life implying many change requests), and on sustainability. This last point is emphasized in computing directly carbon footprint of the building (and the change requests) band in enabling reuse of building materials (quantity, quality, location, … data of the building materials are located in the same place).
For those aspects, the BIM models are not sufficiently well built as for now on the local market. The BIM modeler generally does no fill in the related datas of the model correctly. This could be a result of a lack of worker skills or an insufficient definition of the model requirements… or a lack of interest for BIM in this regard from the Luxemburgish market.

3. Have you relied on training to address these skill gaps by upskilling your staff?

Trainings are available but not a sufficient demand. There is no big enthusiasm for being trained to something which is:

- Not mandatory (legislation of BIM use would have crucial impact on the quality of models)
- Not 100% reliable due to the fact that models are not sufficiently well modelled, and softwares don't consider the local regulations / aspects
- There are not enough feedback on BIM added value (especially quantification of economical and environmental positive impacts)

4. Are you satisfied with the training outcomes of your staff?

Not applicable as well as questions 6 and 7.
Additional questions :

7. Looking at sustainability as a big picture (including economical constraints), what are the most important needed skills required for the different stakeholders (e.g. Clients, architects, structural engineer, MEP engineer, construction work,…)
- High need for more interest for BIM in general on the local market … which would naturally rise the level of BIM models, thus their potential use for such specific studies
- Higher level of skills for BIM modelling in general on the local market
- Having simpler role definition would make up the workflow more efficient.
- BIM-Manager is a crucial role for a BIM base building project. A coordination is important for this new way of exchanging project data.

8. On a more practical point of view, what are the skills required for BIM implementation, is there skill gaps for good BIM implementation
For the interviewee the adequate skill will come naturally with the legislative framework forcing the use of BIM. The training program is ready but not enough people took the trainings so far.

9. What is the added value of BIM to sustainability of buildings

In addition to the answer to the question 3, the BIM opens the way to prefabrication of building or building element. This increases reusability and quality of building works. This comes along with artificial intelligence which should lead to / offer choices for more sustainable solutions and materials.

10. From your opinion, a labelling of worker skills is the adequate way to achieve efficient/sustainable buildings? If not, what would be the best thing to do to ensure good environmental quality of buildings

Make it simple! Make the BIM and/or environmental performance mandatory (with will be controlled by authorities… and then fined if not respected). Only then, things will (naturally) go towards this direction

As for now, environmentally friendly / sustainable solutions are an actual choice (philosophy) for a minority of people. The only reason why most people make energy efficient choices when designing a construction project is the savings they could generate from a low energy consumption building.

Additional resources about BIM training in Luxembourg : https://www.digitalbuilding.lu/formation/introduction/

Learning outcomes of some trainings:

Bim basics : I know the principles of BIM

Bim referent : I can consult a BIM model and exchange information in a BIM project.

Training program : https://www.houseoftraining.lu/en_GB/slides/slide/guide-formations-bim-155

Certification of trainees : CRTIB (Resource Centre for Building Technologies and Innovation) provides certificate for the people that have followed some parts of the BIM learning pathway.

Additional roles suggested by the interviewee:

- BIM manager who coordinates the use of the BIM model. (can be added to the table 1 role, Client & Clients advisors…)
- BIM Information Manager (for handling documents and transfer from/to the BIM platform)

Table 3 (structural design roles) of D2.3 deliverable has been presented to the interviewee.

For Structural design role, the following L.O could be added/modified

LO 3.4 Assist the client to set and specify information requirements and to compare between different structural solutions

LO 4.5 to 4.8 : not for structural design but more on HVAC design.

LO 5.4, 6.3, 6.5, 7 all, 8 all : not for structural engineer but more for BIM manager.

INSTRUCT project. WP2

Interview of Interviewee 2

David's cap for this interview is company manager (he is also involved in BIM Consult company and active member of order of architects and engineers in Luxembourg).

1. What is your role in the project value chain?

BETIC is an HVAC engineering company designing the energy related features of new and refurbished buildings. It also ensures good quality of work execution as well as post occupational optimisation and audits.

2. Do you face any skill gaps in the delivery of energy-efficient and sustainable interventions?

For the interviewee, the skills gaps are mainly linked to the **too narrow** expertise of people. There is **lack of multidisciplinary skills in the teams,** we have to **enlarge the scope of activity (following topics gravitate around energy & sustainability: acoustics, air quality, material quality, security,…). Open minded workers are necessary to achieve high quality buildings, this requires also soft skills as well as experience on what really happens on the construction site.**
Besides, **there are no projects achieved with BIM model integration from beginning to operation**. For parts of projects using BIM, the software developers propose adequate trainings.

3. Can you elaborate on these skill gaps and the ways in which these are addressed on projects?

Cross training of experts with other experts of the company, to acquire a more critical point of view, understanding of the work accomplished by colleagues and other companies.

4. Have you relied on training to address these skill gaps by upskilling your staff?

For **BIM skills, the software developers propose adequate trainings, the company engineers are being trained on request depending on new software updates and tools**. Preparing conventional training on specific tools or methodology is useless, the pace of tools and methods development in BIM is too high. Trainings could be rapidly outdated or not dedicated to specific needs.

5. Has the process of reducing energy skill gaps increased the profitability of your organization?

Opening the mind of workers increases certainly the profitability of the company, it is quite hard to quantify this aspect.

Additional questions:

7. Looking sustainability as a big picture (including economical constraints), what are the most important needed skills required for the different stakeholders (e.g. Clients, architects, structural engineer, MEP engineer, construction work,…)

Think about the complete building life, design, execution, and operation. Involving the building user is important to have an adequate building design and use.

High sustainability level of buildings should be made mandatory. If it is not the case, the people (e.g. investor) do not take the risk to spend more time, money to build better. If it is made mandatory, it requires a clear framework, metrics, and control.

8. On a more practical point of view, what are the skills required for BIM implementation, is there skill gaps for good BIM implementation

For the interviewee***, the adequate integration of BIM tools is crucial***. Nowadays, it is hard to update the energy needs, HVAC design, lighting, acoustic studies in BIM in real time during. Numerous change requests are not compatible with the workload (and associated fee) of HVAC engineering company. The workflow of the project could be adjusted to clearly fix milestones and period where no modification are being made. +

9. What is the added value of BIM to sustainability of buildings

Better feedback during operation phase (energy and comfort optimisation, equipment maintenance)
Create a material library for better reuse of building parts.

10. From your opinion, a labelling of worker skills is the adequate way to achieve efficient/sustainable buildings? If not, what would be the best thing to do to ensure good environmental quality of buildings

For young worker, the diploma is the common way to select the future employee and evaluate their competences (a priori).

Labelling of worker skills could be useful for adequate selection of workers. As mentioned below, the soft skills are important this should be kept in mind while thinking about a labelling.

Learning outcomes

Table 4 (building services design roles) of D2.3 has been shown to the interviewee. The presented learning outcomes seems to be adequate. An additional learning outcome could be set :

Learner is capable of understanding the roles of other roles involved in the project.

12.3.2 Finland - Metropolia

Metropolia had a supportive role in giving useful and high-expertise feedback on the Learning Outcomes Tables.

12.3.3 Cardiff - CU

Cardiff University consulted the tables provided by the School which align with the The Accreditation of Higher Education Programmes (AHEP) by the Engineering Council.

These LO were then translated into the following tables. Out of these tables the statements that were considered aligned with the topic, were translated into Learning Outcomes as explained in the respective chapter of the deliverable.

BEng Civil & Environmental Engineering

UFBGCEEA

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil and environmental engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)**

	• Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3)

	• **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**
KU3	Evaluate the environmental and societal impact of solutions to complex civil & environmental engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil and environmental engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2)

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)**

	• Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems **(Y3)**
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil & environmental engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS2	Select and evaluate technical literature and other sources of information to address complex problems

	• **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS3	Design solutions for complex civil & environmental engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2)

	• **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~

	• ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil & environmental engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1)

	• **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil & environmental engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil & environmental engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2)

	• Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3)

	• Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS4	Function effectively as an individual, and as a member or leader of a team • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1)

	• Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

BEng Civil & Environmental Engineering with a Year in Industry
UFBGCEEB

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil and environmental engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)**

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)**

	• **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**
KU3	Evaluate the environmental and societal impact of solutions to complex civil & environmental engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1)

	• Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** ~~• History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) ~~• Integrated Building Design (Y3)~~ ~~• Architectural Engineering Design Studio (Y3)~~ ~~• Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) ~~• History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)**

	• **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems **(Y3)**
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil & environmental engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3)

	• Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS2	Select and evaluate technical literature and other sources of information to address complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS3	Design solutions for complex civil & environmental engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2)

	• Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3)

	• Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil & environmental engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil & environmental engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2)

	• Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil & environmental engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2~~) • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3)

	• Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS4	Function effectively as an individual, and as a member or leader of a team • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)**

	• **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • **Industrial Experience (YiI)** • **Project (Y3)**

	• Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • **~~Architectural Engineering Design Studio (Y3)~~** • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

MEng Civil & Environmental Engineering

UFMGCEEA

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil and environmental engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **~~History of Western Architecture (Y2)~~** • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)**

	• **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)**

		• **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~

	• **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU3	Evaluate the environmental and societal impact of solutions to complex civil & environmental engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4)

	• Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil and environmental engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **~~Integrated Building Design (Y4)~~** • **~~Building and Infrastructure Information Modelling (Y4)~~** • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)**

	• **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • **Environmental Policy and Regulation (Y3)** • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil & environmental engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)**

		- **Fundamentals of Civil Engineering (Y1)** - Applied Design and Practice (Y1) - Engineering Analysis (Y2) - Building Modelling (Y2) - Hydraulics and Soil Mechanics (Y2) - Professional Studies and Construction (Y2) - Structural Analysis and Design (Y2) - ~~History of Western Architecture (Y2)~~ - Environmental Engineering (Y2) - Industrial Experience (YiI) - Project (Y3) - Construction and Construction Management (Y3) - Structural Analysis (Y3) - Geotechnical Engineering (Y3) - Structural Design Studies (Y3) - Civil Engineering Design (Y3) - Environmental Hydraulics (Y3) - ~~Integrated Building Design (Y3)~~ - ~~Architectural Engineering Design Studio (Y3)~~ - ~~Tensile Structures (Y3)~~ - Environmental Policy and Regulation (Y3) - Water Engineering (Y3) - Concrete Materials and Structures (Y3) - Environmental Geotechnics (Y3) - Waste Management and Recycling (Y3) - Finite Elements for Full-scale Engineering Problems (Y3) - ~~Year in Europe~~ - Professional Engineering Studies (Y4) - ~~**Integrated Building Design (Y4)**~~ - ~~Building and Infrastructure Information Modelling (Y4)~~ - ~~Dynamics (Y4)~~ - Soil and Groundwater Chemistry (Y4) - Industrial Practice (Y4) - **Renewable Energy Design (Y4)** - Flood Design (Y4) - Steel Structures (Y4) - Advanced Structural Mechanics (Y4) - FE Theory and Practice (Y4) - Design Feasibility (Y4) - Applied Numerical Methods in Engineering (Y4)

	• Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~

	• Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS3m	Design solutions for complex civil & environmental engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3)

	• Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2)

	• Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4)

	• Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil & environmental engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4)

	• **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil & environmental engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)**

	• **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil & environmental engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1)

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4)

	• Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~

	• ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~

	• ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~

		• Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)

TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **~~Integrated Building Design (Y4)~~** • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **~~History of Western Architecture (Y2~~)** • **Environmental Engineering (Y2)** • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3)

	• ~~Integrated Building Design (Y3)~~ • **~~Architectural Engineering Design Studio (Y3)~~** • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **~~Integrated Building Design (Y4)~~** • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS7m?	

MEng Civil & Environmental Engineering with a Year in Industry
UFMGCEEB

	Knowledge and Understanding

KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil and environmental engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)**

	• **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**

	• ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU3	Evaluate the environmental and societal impact of solutions to complex civil & environmental engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3)

	• Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • **Environmental Policy and Regulation (Y3)** • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil and environmental engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2)

	• **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~

	• Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • **Environmental Policy and Regulation (Y3)** • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)**

	• **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil & environmental engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • Environmental Engineering (Y2) • Industrial Experience (YiI)

		• **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)

IS3m	Design solutions for complex civil & environmental engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)**

	• **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil & environmental engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3)

	• Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2)

	• **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~

	• Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil & environmental engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • Industrial Practice (Y4)

	• **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil & environmental engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2~~) • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3)

	• Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies~~ (Y4) • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1)

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4)

	• Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~

	• **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3)

	• Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)**

- Engineering Analysis (Y2)
- Building Modelling (Y2)
- Hydraulics and Soil Mechanics (Y2)
- **Professional Studies and Construction (Y2)**
- **Structural Analysis and Design (Y2)**
- ~~History of Western Architecture (Y2)~~
- Environmental Engineering (Y2)

- **Industrial Experience (YiI)**

- **Project (Y3)**
- **Construction and Construction Management (Y3)**
- Structural Analysis (Y3)
- Geotechnical Engineering (Y3)
- Structural Design Studies (Y3)
- **Civil Engineering Design (Y3)**
- **Environmental Hydraulics (Y3)**
- ~~Integrated Building Design (Y3)~~
- ~~Architectural Engineering Design Studio (Y3)~~
- ~~Tensile Structures (Y3)~~
- Environmental Policy and Regulation (Y3)

- Water Engineering (Y3)
- Concrete Materials and Structures (Y3)
- Environmental Geotechnics (Y3)
- Waste Management and Recycling (Y3)
- Finite Elements for Full-scale Engineering Problems (Y3)

- ~~Year in Europe~~

- **Professional Engineering Studies (Y4)**
- ~~**Integrated Building Design (Y4)**~~
- ~~Building and Infrastructure Information Modelling (Y4)~~
- ~~Dynamics (Y4)~~
- **Soil and Groundwater Chemistry (Y4)**
- **Industrial Practice (Y4)**

- **Renewable Energy Design (Y4)**
- **Flood Design (Y4)**
- Steel Structures (Y4)
- Advanced Structural Mechanics (Y4)
- FE Theory and Practice (Y4)
- Design Feasibility (Y4)
- Applied Numerical Methods in Engineering (Y4)
- Coastal and Estuarine Engineering (Y4)
- Soil Mechanics (Y4)

	• Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • Environmental Policy and Regulation (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~

	• Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS7 ?	

MEng (International) Civil & Environmental Engineering
UFMGCEEF

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil and environmental engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3)

	• ~~**Tensile Structures (Y3)**~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL)

	• **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~**Tensile Structures (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • **Environmental Fluid Mechanics (Y4)** • **Big Data and AI in Civil Engineering (Y4)**
KU3	Evaluate the environmental and societal impact of solutions to complex civil & environmental engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2)

	• ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil and environmental engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2)

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1)

	• Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Intellectual Skills

IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil & environmental engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4)

	• ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)**

	• Coastal and Estuarine Engineering (Y4) • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS3m	Design solutions for complex civil & environmental engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~

	• **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~

	• ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil & environmental engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil & environmental engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3)

	• ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil & environmental engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL)

	• Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~

	• Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)

TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~

	• Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~**Dynamics (Y4)**~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4)

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Soil Mechanics (Y4)
Structural Engineering (Y4)
Fundamentals of Nanomechanics (Y4)
Sediment Transport Dynamics (Y4)
<s>Environmental Building Studies (Y4)</s>
Environmental Fluid Mechanics (Y4)
Big Data and AI in Civil Engineering (Y4)

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<tr><td>TS5</td><td>
Plan and record self-learning and development as the foundation for lifelong learning/CPD

Engineering Maths and Computation (Y1)
Fundamentals of Civil Engineering (Y1)
Applied Design and Practice (Y1)

Engineering Analysis (Y2)
Building Modelling (Y2)
Hydraulics and Soil Mechanics (Y2)
Professional Studies and Construction (Y2)
Structural Analysis and Design (Y2)
<s>History of Western Architecture (Y2)</s>
Environmental Engineering (Y2)

Industrial Experience (YiL)

Project (Y3)
International Experience (Y3)
International Engineering Studies (Y3)
<s>Tensile Structures (Y3)</s>

Water Engineering (Y3)
Concrete Materials and Structures (Y3)
Environmental Geotechnics (Y3)
Waste Management and Recycling (Y3)
Finite Elements for Full-scale Engineering Problems (Y3)

Professional Engineering Studies (Y4)
<s>Integrated Building Design (Y4)</s>
<s>Building and Infrastructure Information Modelling (Y4)</s>
<s>Dynamics (Y4)</s>
Soil and Groundwater Chemistry (Y4)
Industrial Practice (Y4)

Renewable Energy Design (Y4)
Flood Design (Y4)
Steel Structures (Y4)
Advanced Structural Mechanics (Y4)
FE Theory and Practice (Y4)

</td></tr>
</table>

	• Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS6m	Demonstrate understanding of an additional, "international" culture, and appreciation of the technical focus provided at international universities • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • **International Experience (Y3)** • **International Engineering Studies (Y3)** • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4)

	• Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)

MEng (International) Civil & Environmental Engineering with a Year in Industry
UFMGCEEG

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil and environmental engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~**Tensile Structures (Y3)**~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

	• Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~**Tensile Structures (Y3)**~~ • **Water Engineering (Y3)**

	• **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • **Environmental Fluid Mechanics (Y4)** • **Big Data and AI in Civil Engineering (Y4)**
KU3	Evaluate the environmental and societal impact of solutions to complex civil & environmental engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • **Environmental Engineering (Y2)** • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3)

	• International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil and environmental engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL)

	• Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2)

	• ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil & environmental engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1)

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4)

	• Big Data and AI in Civil Engineering (Y4)
IS3m	Design solutions for complex civil & environmental engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4)

	• Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)**

	• **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil & environmental engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~

	• Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • ~~Sediment Transport Dynamics (Y4)~~ • Environmental Building Studies (Y4) • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4)

	• ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil & environmental engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3)

	• Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil & environmental engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3)

	• Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3)

	• International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2)

	• **Industrial Experience (YiL)** • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)**

	• **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2)

	• Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1)

		• **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)

TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~**Dynamics (Y4)**~~ • **Soil and Groundwater Chemistry (Y4)** • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~

	• Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • **Environmental Engineering (Y2)** • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • **Industrial Practice (Y4)** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)**

	• Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
TS6m	Demonstrate understanding of an additional, “international” culture, and appreciation of the technical focus provided at international universities • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • Environmental Engineering (Y2) • Industrial Experience (YiL) • Project (Y3) • **International Experience (Y3)** • **International Engineering Studies (Y3)** • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4)

	• Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)

BEng Architectural Engineering

UFBGAENA

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in architectural engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3)

	• Finite Elements for Full-scale Engineering Problems (Y3)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • Environmental Policy and Regulation (Y3) • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • ~~**Environmental Geotechnics (Y3)**~~ • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**
KU3	Evaluate the environmental and societal impact of solutions to complex architectural engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • Professional Studies and Construction (Y2)

	• Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3)

	• Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems **(Y3)**
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of architectural engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)**

	• Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS2	Select and evaluate technical literature and other sources of information to address complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)**

	• Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS3	Design solutions for complex architectural engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)**

	• Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (Yil) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • **Integrated Building Design (Y3)** • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in architectural engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)**

	• Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular architectural engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in architectural engineering

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)**

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3)

	• Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS4	Function effectively as an individual, and as a member or leader of a team • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

BEng Architectural Engineering with a Year in Industry

UFBGAENB

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in architectural engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)**

	• **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • Environmental Policy and Regulation (Y3) • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • ~~**Environmental Geotechnics (Y3)**~~ • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**
KU3	Evaluate the environmental and societal impact of solutions to complex architectural engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)**

	• Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) ~~• **Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) ~~• **Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) ~~• Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems **(Y3)**
	Intellectual Skills

IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of architectural engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS2	Select and evaluate technical literature and other sources of information to address complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~Environmental Engineering (Y2)~~

	• Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS3	Design solutions for complex architectural engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)**

	• Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • **Integrated Building Design (Y3)** • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in architectural engineering to investigate complex problems

	• **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3)

	• Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular architectural engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • Environmental Engineering (Y2) • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in architectural engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2)

	• Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • Soil and Groundwater Chemistry (Y4) • Industrial Practice (Y4) • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • Environmental Fluid Mechanics (Y4)

	• Big Data and AI in Civil Engineering (Y4)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)**

	• Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)**

	• Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS4	Function effectively as an individual, and as a member or leader of a team • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

MEng Architectural Engineering
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	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in architectural engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)**

		• **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • **Environmental Building Studies (Y4)** • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • ~~Environmental Policy and Regulation (Y3)~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4)

	• Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU3	Evaluate the environmental and societal impact of solutions to complex architectural engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

	• ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3)

	• Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2)

- **Professional Studies and Construction (Y2)**
- Structural Analysis and Design (Y2)
- History of Western Architecture (Y2)
- ~~Environmental Engineering (Y2)~~

- Industrial Experience (YiI)

- **Project (Y3)**
- **Construction and Construction Management (Y3)**
- Structural Analysis (Y3)
- Geotechnical Engineering (Y3)
- **Structural Design Studies (Y3)**
- **Civil Engineering Design (Y3)**
- Environmental Hydraulics (Y3)
- Integrated Building Design (Y3)
- **Architectural Engineering Design Studio (Y3)**
- Tensile Structures (Y3)
- ~~**Environmental Policy and Regulation (Y3)**~~

- Water Engineering (Y3)
- Concrete Materials and Structures (Y3)
- **Environmental Geotechnics (Y3)**
- **Waste Management and Recycling (Y3)**
- Finite Elements for Full-scale Engineering Problems (Y3)

- ~~Year in Europe~~

- **Professional Engineering Studies (Y4)**
- **Integrated Building Design (Y4)**
- **Building and Infrastructure Information Modelling (Y4)**
- Dynamics (Y4)
- ~~**Soil and Groundwater Chemistry (Y4)**~~
- ~~**Industrial Practice (Y4)**~~

- **Renewable Energy Design (Y4)**
- **Flood Design (Y4)**
- Steel Structures (Y4)
- Advanced Structural Mechanics (Y4)
- **FE Theory and Practice (Y4)**
- **Design Feasibility (Y4)**
- Applied Numerical Methods in Engineering (Y4)
- **Coastal and Estuarine Engineering (Y4)**
- Soil Mechanics (Y4)
- Structural Engineering (Y4)
- Fundamentals of Nanomechanics (Y4)
- Sediment Transport Dynamics (Y4)
- **Environmental Building Studies (Y4)**

	• ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of architectural engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~

	~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) ~~Environmental Fluid Mechanics (Y4)~~ ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) ~~Environmental Policy and Regulation (Y3)~~

	• Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS3m	Design solutions for complex architectural engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2)

- **Professional Studies and Construction (Y2)**
- **Structural Analysis and Design (Y2)**
- History of Western Architecture (Y2)
- ~~Environmental Engineering (Y2)~~

- **Industrial Experience (YiI)**

- **Project (Y3)**
- Construction and Construction Management (Y3)
- Structural Analysis (Y3)
- Geotechnical Engineering (Y3)
- **Structural Design Studies (Y3)**
- **Civil Engineering Design (Y3)**
- **Environmental Hydraulics (Y3)**
- **Integrated Building Design (Y3)**
- **Architectural Engineering Design Studio (Y3)**
- Tensile Structures (Y3)
- ~~Environmental Policy and Regulation (Y3)~~

- Water Engineering (Y3)
- Concrete Materials and Structures (Y3)
- **Environmental Geotechnics (Y3)**
- Waste Management and Recycling (Y3)
- Finite Elements for Full-scale Engineering Problems (Y3)

- ~~Year in Europe~~

- Professional Engineering Studies (Y4)
- **Integrated Building Design (Y4)**
- **Building and Infrastructure Information Modelling (Y4)**
- Dynamics (Y4)
- ~~**Soil and Groundwater Chemistry (Y4)**~~
- ~~**Industrial Practice (Y4)**~~

- **Renewable Energy Design (Y4)**
- **Flood Design (Y4)**
- Steel Structures (Y4)
- Advanced Structural Mechanics (Y4)
- FE Theory and Practice (Y4)
- **Design Feasibility (Y4)**
- Applied Numerical Methods in Engineering (Y4)
- Coastal and Estuarine Engineering (Y4)
- Soil Mechanics (Y4)
- Structural Engineering (Y4)
- Fundamentals of Nanomechanics (Y4)
- Sediment Transport Dynamics (Y4)
- Environmental Building Studies (Y4)

	~~Environmental Fluid Mechanics (Y4)~~ ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • **Integrated Building Design (Y3)** • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) ~~Soil and Groundwater Chemistry (Y4)~~ ~~Industrial Practice (Y4)~~

	• **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in architectural engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3)

	• Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular architectural engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4)

	• Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in architectural engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4)

	• Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • **Integrated Building Design (Y3)** • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~

	• Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)**

	• History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • Big Data and AI in Civil Engineering (Y4)

TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~

	• Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)**

	• Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)**

	• **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

TS7m?	

MEng Architectural Engineering with a Year in Industry
UFMGAENB

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in architectural engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~

	• **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • **Environmental Building Studies (Y4)** • **Environmental Fluid Mechanics (Y4)** • Big Data and AI in Civil Engineering (Y4)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • Integrated Building Design (Y3)

	• **Architectural Engineering Design Studio (Y3)** • **Tensile Structures (Y3)** • ~~Environmental Policy and Regulation (Y3)~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU3	Evaluate the environmental and societal impact of solutions to complex architectural engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2)

		• History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~**Environmental Policy and Regulation (Y3)**~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

	• ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • **Environmental Building Studies (Y4)** • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of architectural engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3)

	• Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1)

		• **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)**

	• **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS3m	Design solutions for complex architectural engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **Integrated Building Design (Y3)** • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • **Integrated Building Design (Y3)** • Architectural Engineering Design Studio (Y3)

	• Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in architectural engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2)

	• ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular architectural engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~

	• Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in architectural engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • Integrated Building Design (Y3)

	• Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2)

		• History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • **Integrated Building Design (Y3)** • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4)

	• Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3)

	• Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2)

		• Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~

	• ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • Integrated Building Design (Y3) • Architectural Engineering Design Studio (Y3) • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~

	• **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • Integrated Building Design (Y3) • **Architectural Engineering Design Studio (Y3)** • Tensile Structures (Y3) • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3)

	• **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS7?	

MEng (International) Architectural Engineering
UFMGAENF

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in architectural engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)**

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • **Tensile Structures (Y3)** • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • **Environmental Building Studies (Y4)** • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1)

	• Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • **Tensile Structures (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~**Big Data and AI in Civil Engineering (Y4)**~~

KU3	Evaluate the environmental and societal impact of solutions to complex architectural engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4)

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Environmental Building Studies (Y4)
~~Environmental Fluid Mechanics (Y4)~~
~~Big Data and AI in Civil Engineering (Y4)~~

</td></tr>
<tr><td>KU4</td><td>
Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems

Engineering Maths and Computation (Y1)
Fundamentals of Civil Engineering (Y1)
Applied Design and Practice (Y1)

Engineering Analysis (Y2)
Building Modelling (Y2)
Hydraulics and Soil Mechanics (Y2)
Professional Studies and Construction (Y2)
Structural Analysis and Design (Y2)
History of Western Architecture (Y2)
~~Environmental Engineering (Y2)~~

Industrial Experience (YiL)

Project (Y3)
International Experience (Y3)
International Engineering Studies (Y3)
Tensile Structures (Y3)

Water Engineering (Y3)
Concrete Materials and Structures (Y3)
Environmental Geotechnics (Y3)
Waste Management and Recycling (Y3)
Finite Elements for Full-scale Engineering Problems (Y3)

Professional Engineering Studies (Y4)
Integrated Building Design (Y4)
Building and Infrastructure Information Modelling (Y4)
Dynamics (Y4)
~~Soil and Groundwater Chemistry (Y4)~~
~~Industrial Practice (Y4)~~

Renewable Energy Design (Y4)
Flood Design (Y4)
Steel Structures (Y4)
Advanced Structural Mechanics (Y4)
FE Theory and Practice (Y4)
Design Feasibility (Y4)
Applied Numerical Methods in Engineering (Y4)
Coastal and Estuarine Engineering (Y4)
Soil Mechanics (Y4)

</td></tr>
</table>

	• Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)**

	• **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • **Environmental Building Studies (Y4)** • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of architectural engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~

	• **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)**

	• **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~Soil and Groundwater Chemistry (Y4)~~ • **~~Industrial Practice (Y4)~~** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS3m	Design solutions for complex architectural engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3)

	• Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3)

	• International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in architectural engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~

	• Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)**

	• History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • Big Data and AI in Civil Engineering (Y4)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular architectural engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2)

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in architectural engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1)

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects

- Engineering Maths and Computation (Y1)
- Fundamentals of Civil Engineering (Y1)
- **Applied Design and Practice (Y1)**

- Engineering Analysis (Y2)
- Building Modelling (Y2)
- Hydraulics and Soil Mechanics (Y2)
- Professional Studies and Construction (Y2)
- Structural Analysis and Design (Y2)
- History of Western Architecture (Y2)
- ~~Environmental Engineering (Y2)~~

- Industrial Experience (YiL)

- Project (Y3)
- International Experience (Y3)
- International Engineering Studies (Y3)
- Tensile Structures (Y3)

- Water Engineering (Y3)
- Concrete Materials and Structures (Y3)
- Environmental Geotechnics (Y3)
- Waste Management and Recycling (Y3)
- Finite Elements for Full-scale Engineering Problems (Y3)

- Professional Engineering Studies (Y4)
- **Integrated Building Design (Y4)**
- Building and Infrastructure Information Modelling (Y4)
- Dynamics (Y4)
- ~~Soil and Groundwater Chemistry (Y4)~~
- ~~Industrial Practice (Y4)~~

- **Renewable Energy Design (Y4)**
- Flood Design (Y4)
- Steel Structures (Y4)
- Advanced Structural Mechanics (Y4)
- FE Theory and Practice (Y4)
- **Design Feasibility (Y4)**
- Applied Numerical Methods in Engineering (Y4)
- Coastal and Estuarine Engineering (Y4)
- Soil Mechanics (Y4)
- Structural Engineering (Y4)
- Fundamentals of Nanomechanics (Y4)
- Sediment Transport Dynamics (Y4)
- Environmental Building Studies (Y4)
- ~~Environmental Fluid Mechanics (Y4)~~

	• ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4)

	• **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4)

	• Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~

	• Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • So_il Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • Integrated Building Design (Y4)

	• Building and Infrastructure Information Modelling (Y4) • **Dynamics (Y4)** • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

<table>
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Professional Engineering Studies (Y4)
Integrated Building Design (Y4)
Building and Infrastructure Information Modelling (Y4)
Dynamics (Y4)
<s>Soil and Groundwater Chemistry (Y4)</s>
<s>Industrial Practice (Y4)</s>

Renewable Energy Design (Y4)
Flood Design (Y4)
Steel Structures (Y4)
Advanced Structural Mechanics (Y4)
FE Theory and Practice (Y4)
Design Feasibility (Y4)
Applied Numerical Methods in Engineering (Y4)
Coastal and Estuarine Engineering (Y4)
Soil Mechanics (Y4)
Structural Engineering (Y4)
Fundamentals of Nanomechanics (Y4)
Sediment Transport Dynamics (Y4)
Environmental Building Studies (Y4)
<s>Environmental Fluid Mechanics (Y4)</s>
<s>Big Data and AI in Civil Engineering (Y4)</s>

</td></tr>
<tr><td>TS6m</td><td>
Demonstrate understanding of an additional, “international” culture, and appreciation of the technical focus provided at international universities

Engineering Maths and Computation (Y1)
Fundamentals of Civil Engineering (Y1)
Applied Design and Practice (Y1)

Engineering Analysis (Y2)
Building Modelling (Y2)
Hydraulics and Soil Mechanics (Y2)
Professional Studies and Construction (Y2)
Structural Analysis and Design (Y2)
History of Western Architecture (Y2)
<s>Environmental Engineering (Y2)</s>

Industrial Experience (YiL)

Project (Y3)
International Experience (Y3)
International Engineering Studies (Y3)
Tensile Structures (Y3)

Water Engineering (Y3)
Concrete Materials and Structures (Y3)
Environmental Geotechnics (Y3)

</td></tr>
</table>

	• Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

MEng (International) Architectural Engineering with a Year in Industry
UFMGAENG

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in architectural engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)**

	• ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • **Tensile Structures (Y3)** • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • **Environmental Building Studies (Y4)** • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)**

	• **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • **Tensile Structures (Y3)** • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~**Big Data and AI in Civil Engineering (Y4)**~~
KU3	Evaluate the environmental and societal impact of solutions to complex architectural engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)**

	• Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~

	• ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4)

	• Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • **Environmental Building Studies (Y4)** • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of architectural engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • **Dynamics (Y4)** • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~

	• Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS3m	Design solutions for complex architectural engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)**

	• Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • **Building and Infrastructure Information Modelling (Y4)** • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3)

	• Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in architectural engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3)

	• International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL)

	• Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular architectural engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2)

	• ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in architectural engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2)

	• **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~

	• ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4)

	• Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) ~~• Environmental Fluid Mechanics (Y4)~~ ~~• Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) ~~• Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) ~~• Soil and Groundwater Chemistry (Y4)~~ ~~• Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4)

	• Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **Integrated Building Design (Y4)** • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4)

	• Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • **Dynamics (Y4)** • ~~**Soil and Groundwater Chemistry (Y4)**~~

	• ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **History of Western Architecture (Y2)** • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • **Integrated Building Design (Y4)**

	• Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS6m	Demonstrate understanding of an additional, “international” culture, and appreciation of the technical focus provided at international universities • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • History of Western Architecture (Y2) • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • **International Experience (Y3)** • **International Engineering Studies (Y3)** • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• Professional Engineering Studies (Y4) • Integrated Building Design (Y4) • Building and Infrastructure Information Modelling (Y4) • Dynamics (Y4) • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

BEng Civil Engineering
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	Knowledge and Understanding
KU1	**Apply knowledge** of mathematics, statistics, natural science and engineering principles **to the solution of complex problems** in civil engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)**

	• **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU2	**Formulate and analyse complex problems** in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~Environmental Policy and Regulation (Y3)~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)**

	• Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**
KU3	**Evaluate** the environmental and societal impact of solutions to **complex civil engineering problems** (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)**

	• **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU5	**Use and understand engineering management principles**, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~

	• ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems **(Y3)**
	Intellectual Skills
IS1	**Select and apply** appropriate computational and analytical techniques, **recognising the limitations** of the techniques employed, for the synthesis of civil engineering problems, and to **make judgements** on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS2	**Select and evaluate technical** literature and other sources of information to address complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)**

	• **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS3	**Design solutions for complex civil engineering problems** that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)**

	• **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS4	**Apply** an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~

	• ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Professional Practical Skills
PS1	**Use** practical laboratory and field-based skills in civil engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS2	**Select and apply** appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)**

	• **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
PS3	**Use** a risk management process to **identify, evaluate and mitigate** risks (the effects of uncertainty) associated with a particular civil engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3)

	• Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS4	**Adopt** a holistic and proportionate approach to the mitigation of security risks in civil engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	Transferable/Key Skills
TS1	**Communicate** effectively on complex engineering matters with technical and non-technical audiences**, evaluating** the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS2	**Identify and analyse** ethical concerns and **make reasoned ethical choices** informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)**

	• Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS3	**Adopt** an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~

	• ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS4	Function effectively as an individual, and as a member or leader of a team • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

BEng Civil Engineering with a Year in Industry
UFBGCENB

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)**

	• **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~

	• ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~Environmental Policy and Regulation (Y3)~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)**
KU3	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex architectural engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1)

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems **(Y3)**
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

IS2	Select and evaluate technical literature and other sources of information to address complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS3	Design solutions for complex civil engineering problems that meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)**

	• **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)**

	• **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations

	• Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)**

	• **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

PS6 ?	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2)

	• **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~

	• ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • **~~Architectural Engineering Design Studio (Y3)~~** • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS4	Function effectively as an individual, and as a member or leader of a team • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2)

	• Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)**

	• Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • **~~Architectural Engineering Design Studio (Y3)~~** • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

MEng Civil Engineering
UFMGCENA

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **~~History of Western Architecture (Y2)~~** • **~~Environmental Engineering (Y2)~~** • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • **~~Integrated Building Design (Y3)~~** • **~~Architectural Engineering Design Studio (Y3)~~**

	• ~~**Tensile Structures (Y3)**~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~

		• ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~Environmental Policy and Regulation (Y3)~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~**Big Data and AI in Civil Engineering (Y4)**~~

KU3	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4)

	• Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • Environmental Building Studies (Y4) • Environmental Fluid Mechanics (Y4) • Big Data and AI in Civil Engineering (Y4)
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3)

	• ~~Integrated Building Design (Y3)~~ • **~~Architectural Engineering Design Studio (Y3)~~** • ~~Tensile Structures (Y3)~~ • **~~Environmental Policy and Regulation (Y3)~~** • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • **~~Integrated Building Design (Y4)~~** • **~~Building and Infrastructure Information Modelling (Y4)~~** • ~~Dynamics (Y4)~~ • **~~Soil and Groundwater Chemistry (Y4)~~** • **~~Industrial Practice (Y4)~~** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • **~~Environmental Building Studies (Y4)~~** • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2)

		• Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~

	• ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **~~History of Western Architecture (Y2)~~** • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • **~~Architectural Engineering Design Studio (Y3)~~** • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **~~Integrated Building Design (Y4)~~** • **~~Building and Infrastructure Information Modelling (Y4)~~** • **~~Dynamics (Y4)~~** • ~~Soil and Groundwater Chemistry (Y4)~~

	• ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS3m	Design solutions for complex civil engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~

	• ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~

	• Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills

PS1	Use practical laboratory and field-based skills in civil engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~

	• Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~

	• ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~

		~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** ~~Integrated Building Design (Y3)~~ ~~Architectural Engineering Design Studio (Y3)~~ ~~Tensile Structures (Y3)~~ ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** ~~Integrated Building Design (Y4)~~ ~~Building and Infrastructure Information Modelling (Y4)~~ ~~Dynamics (Y4)~~ ~~Soil and Groundwater Chemistry (Y4)~~ ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) ~~Environmental Building Studies (Y4)~~ ~~Environmental Fluid Mechanics (Y4)~~ ~~Big Data and AI in Civil Engineering (Y4)~~

PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4)

	• Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3)

	• Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **~~Integrated Building Design (Y4)~~** • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **~~Soil and Groundwater Chemistry (Y4)~~** • **~~Industrial Practice (Y4)~~** • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2)

		• Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4)

	• Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~

	~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3)

	• **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS7m?	

MEng Civil Engineering with a Year in Industry
UFMGCENB

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2)

		• **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~

	• ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • **Geotechnical Engineering (Y3)** • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~**Tensile Structures (Y3)**~~ • ~~Environmental Policy and Regulation (Y3)~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~

	• **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~**Big Data and AI in Civil Engineering (Y4)**~~
KU3	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~**Environmental Policy and Regulation (Y3)**~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)**

	• **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • **Construction and Construction Management (Y3)** • Structural Analysis (Y3)

	• Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1)

- Engineering Analysis (Y2)
- Building Modelling (Y2)
- Hydraulics and Soil Mechanics (Y2)
- **Professional Studies and Construction (Y2)**
- Structural Analysis and Design (Y2)
- ~~History of Western Architecture (Y2)~~
- ~~Environmental Engineering (Y2)~~

- Industrial Experience (YiI)

- **Project (Y3)**
- **Construction and Construction Management (Y3)**
- Structural Analysis (Y3)
- Geotechnical Engineering (Y3)
- **Structural Design Studies (Y3)**
- **Civil Engineering Design (Y3)**
- Environmental Hydraulics (Y3)
- ~~Integrated Building Design (Y3)~~
- ~~**Architectural Engineering Design Studio (Y3)**~~
- ~~Tensile Structures (Y3)~~
- ~~**Environmental Policy and Regulation (Y3)**~~

- Water Engineering (Y3)
- Concrete Materials and Structures (Y3)
- **Environmental Geotechnics (Y3)**
- **Waste Management and Recycling (Y3)**
- Finite Elements for Full-scale Engineering Problems (Y3)

- ~~Year in Europe~~

- **Professional Engineering Studies (Y4)**
- ~~**Integrated Building Design (Y4)**~~
- ~~**Building and Infrastructure Information Modelling (Y4)**~~
- ~~Dynamics (Y4)~~
- ~~**Soil and Groundwater Chemistry (Y4)**~~
- ~~**Industrial Practice (Y4)**~~

- **Renewable Energy Design (Y4)**
- **Flood Design (Y4)**
- Steel Structures (Y4)
- Advanced Structural Mechanics (Y4)
- **FE Theory and Practice (Y4)**
- **Design Feasibility (Y4)**
- Applied Numerical Methods in Engineering (Y4)
- **Coastal and Estuarine Engineering (Y4)**
- Soil Mechanics (Y4)
- Structural Engineering (Y4)

	• Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~

	• ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • **Structural Analysis (Y3)** • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~

	• ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS3m	Design solutions for complex civil engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2)

		• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~**Integrated Building Design (Y3)**~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4)

	• ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~

	• **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3)

	• Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3)

	• Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **~~Integrated Building Design (Y4)~~** • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • **~~Soil and Groundwater Chemistry (Y4)~~** • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4)

	• Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~

	• ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • **Civil Engineering Design (Y3)** • Environmental Hydraulics (Y3) • ~~**Integrated Building Design (Y3)**~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3)

	• Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI)

	• Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)**

	• **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4)

	• Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~

	• ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiI) • Project (Y3) • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~

	• Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • Professional Engineering Studies (Y4) • **~~Integrated Building Design (Y4)~~** • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~

	• **Industrial Experience (YiI)** • **Project (Y3)** • **Construction and Construction Management (Y3)** • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • Structural Design Studies (Y3) • **Civil Engineering Design (Y3)** • **Environmental Hydraulics (Y3)** • ~~Integrated Building Design (Y3)~~ • ~~Architectural Engineering Design Studio (Y3)~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiI)** • **Project (Y3)** • Construction and Construction Management (Y3) • Structural Analysis (Y3) • Geotechnical Engineering (Y3) • **Structural Design Studies (Y3)** • Civil Engineering Design (Y3) • Environmental Hydraulics (Y3) • ~~Integrated Building Design (Y3)~~ • ~~**Architectural Engineering Design Studio (Y3)**~~ • ~~Tensile Structures (Y3)~~ • ~~Environmental Policy and Regulation (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • ~~Year in Europe~~ • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4)

	• **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS7m?	

MEng (International) Civil Engineering

UFMGCENF

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • **~~History of Western Architecture (Y2)~~** • **~~Environmental Engineering (Y2)~~** • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • **~~Tensile Structures (Y3)~~** • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

	• Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~**Tensile Structures (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)**

	• Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~**Big Data and AI in Civil Engineering (Y4)**~~
KU3	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~

	• **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3)

	• International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • **~~Integrated Building Design (Y4)~~** • **~~Building and Infrastructure Information Modelling (Y4)~~** • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • **~~Industrial Practice (Y4)~~** • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~

	• Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2)

	• Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1)

	• Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~	

IS3m	Design solutions for complex civil engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)**

	• Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~

	• Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~

	• ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4)

	• ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3)

	• Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)**

	• **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~

	• ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2)

	• Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)**

	• Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~**Dynamics (Y4)**~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

TS6m	Demonstrate understanding of an additional, "international" culture, and appreciation of the technical focus provided at international universities • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • **International Experience (Y3)** • **International Engineering Studies (Y3)** • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~

	• ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~

MEng (International) Civil Engineering with a Year in Industry
UFMGCENG

	Knowledge and Understanding
KU1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems in civil engineering • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~**History of Western Architecture (Y2)**~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~**Tensile Structures (Y3)**~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)**

	• **Flood Design (Y4)** • **Steel Structures (Y4)** • **Advanced Structural Mechanics (Y4)** • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~**Environmental Building Studies (Y4)**~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU2	Formulate and analyse complex problems in integrated systems to reach substantiated conclusions, using engineering judgment to work with information that may be uncertain or incomplete • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • **Engineering Analysis (Y2)** • Building Modelling (Y2) • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~**Tensile Structures (Y3)**~~ • **Water Engineering (Y3)** • **Concrete Materials and Structures (Y3)** • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • **Finite Elements for Full-scale Engineering Problems (Y3)** • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~

	• ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • **Coastal and Estuarine Engineering (Y4)** • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • **Fundamentals of Nanomechanics (Y4)** • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~**Environmental Fluid Mechanics (Y4)**~~ • ~~**Big Data and AI in Civil Engineering (Y4)**~~
KU3	Evaluate the environmental and societal impact of solutions to complex civil engineering problems (to include the entire life-cycle of a product or process) and minimise adverse impacts • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~**Environmental Engineering (Y2)**~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • **Water Engineering (Y3)** • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3)

	• Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU4	Understand the role of quality management systems and continuous improvement in the context of complex civil engineering problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3)

	• Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
KU5	Use and understand engineering management principles, commercial contexts, project and change management, and relevant legal matters including intellectual property rights • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~

	• Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • **Coastal and Estuarine Engineering (Y4)** • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~**Environmental Building Studies (Y4)**~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Intellectual Skills
IS1	Select and apply appropriate computational and analytical techniques, recognising the limitations of the techniques employed, for the synthesis of civil engineering problems, and to make judgements on appropriate action • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL)

	• Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • Tensile Structures (Y3) • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • **Fundamentals of Nanomechanics (Y4)** • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS2m	Select and critically evaluate technical literature and other sources of information to solve complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • **Hydraulics and Soil Mechanics (Y2)** • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)**

	• ~~**History of Western Architecture (Y2)**~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • **Concrete Materials and Structures (Y3)** • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~**Dynamics (Y4)**~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • **FE Theory and Practice (Y4)** • **Design Feasibility (Y4)** • **Applied Numerical Methods in Engineering (Y4)** • Coastal and Estuarine Engineering (Y4) • **Soil Mechanics (Y4)** • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~	

IS3m	Design solutions for complex civil engineering problems that evidence some originality, and meet a combination of societal, user, business and customer needs as appropriate, with consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~**Building and Infrastructure Information Modelling (Y4)**~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4)

	• Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
IS4	Apply an integrated or systems approach to the solution of complex problems • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4)

	• Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Professional Practical Skills
PS1	Use practical laboratory and field-based skills in civil engineering to investigate complex problems • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4)

	• **FE Theory and Practice (Y4)** • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS2	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • Applied Design and Practice (Y1) • **Engineering Analysis (Y2)** • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • **Waste Management and Recycling (Y3)** • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)**

	• **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • **Structural Engineering (Y4)** • Fundamentals of Nanomechanics (Y4) • **Sediment Transport Dynamics (Y4)** • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS3	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular civil engineering project or activity • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • **Environmental Geotechnics (Y3)** • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~

	~~**Industrial Practice (Y4)**~~ • Renewable Energy Design (Y4) • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~	
PS4	Adopt a holistic and proportionate approach to the mitigation of security risks in civil engineering • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~	

	• ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS5m	Integrate knowledge, understanding, skills and creativity to solve a substantial range of engineering problems, some of them novel or complex, especially through participation in group design projects • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3)

	• Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • **Renewable Energy Design (Y4)** • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
PS6	Demonstrate the benefits of structured training in an extended industrial placement, to gain experience and increase appreciation of the application of engineering principles in a commercial setting • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3)

	• Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
	Transferable/Key Skills
TS1	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used • **Engineering Maths and Computation (Y1)** • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • **Building Modelling (Y2)** • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3)

	• International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS2	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL)

	• **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS3	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~

	• ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~**Integrated Building Design (Y4)**~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • **Design Feasibility (Y4)** • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS4m	Function effectively as an individual, and as a member or leader of a team, and evaluate effectiveness of own and team performance • Engineering Maths and Computation (Y1) • **Fundamentals of Civil Engineering (Y1)** • **Applied Design and Practice (Y1)** • Engineering Analysis (Y2) • Building Modelling (Y2)

	• Hydraulics and Soil Mechanics (Y2) • **Professional Studies and Construction (Y2)** • **Structural Analysis and Design (Y2)** • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • **Industrial Experience (YiL)** • **Project (Y3)** • International Experience (Y3) • International Engineering Studies (Y3) • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • **Professional Engineering Studies (Y4)** • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~**Dynamics (Y4)**~~ • ~~**Soil and Groundwater Chemistry (Y4)**~~ • ~~**Industrial Practice (Y4)**~~ • **Renewable Energy Design (Y4)** • **Flood Design (Y4)** • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~
TS5	Plan and record self-learning and development as the foundation for lifelong learning/CPD • Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • **Applied Design and Practice (Y1)**

<table>
<tr><td></td><td>

Engineering Analysis (Y2)
Building Modelling (Y2)
Hydraulics and Soil Mechanics (Y2)
Professional Studies and Construction (Y2)
Structural Analysis and Design (Y2)
<s>History of Western Architecture (Y2)</s>
<s>Environmental Engineering (Y2)</s>

Industrial Experience (YiL)

Project (Y3)
International Experience (Y3)
International Engineering Studies (Y3)
<s>Tensile Structures (Y3)</s>

Water Engineering (Y3)
Concrete Materials and Structures (Y3)
Environmental Geotechnics (Y3)
Waste Management and Recycling (Y3)
Finite Elements for Full-scale Engineering Problems (Y3)

Professional Engineering Studies (Y4)
<s>Integrated Building Design (Y4)</s>
<s>Building and Infrastructure Information Modelling (Y4)</s>
<s>Dynamics (Y4)</s>
<s>Soil and Groundwater Chemistry (Y4)</s>
<s>Industrial Practice (Y4)</s>

Renewable Energy Design (Y4)
Flood Design (Y4)
Steel Structures (Y4)
Advanced Structural Mechanics (Y4)
FE Theory and Practice (Y4)
Design Feasibility (Y4)
Applied Numerical Methods in Engineering (Y4)
Coastal and Estuarine Engineering (Y4)
Soil Mechanics (Y4)
Structural Engineering (Y4)
Fundamentals of Nanomechanics (Y4)
Sediment Transport Dynamics (Y4)
<s>Environmental Building Studies (Y4)</s>
<s>Environmental Fluid Mechanics (Y4)</s>
<s>Big Data and AI in Civil Engineering (Y4)</s>

</td></tr>
<tr><td>TS6m</td><td>Demonstrate understanding of an additional, “international” culture, and appreciation of the technical focus provided at international universities</td></tr>
</table>

	• Engineering Maths and Computation (Y1) • Fundamentals of Civil Engineering (Y1) • Applied Design and Practice (Y1) • Engineering Analysis (Y2) • Building Modelling (Y2) • Hydraulics and Soil Mechanics (Y2) • Professional Studies and Construction (Y2) • Structural Analysis and Design (Y2) • ~~History of Western Architecture (Y2)~~ • ~~Environmental Engineering (Y2)~~ • Industrial Experience (YiL) • Project (Y3) • **International Experience (Y3)** • **International Engineering Studies (Y3)** • ~~Tensile Structures (Y3)~~ • Water Engineering (Y3) • Concrete Materials and Structures (Y3) • Environmental Geotechnics (Y3) • Waste Management and Recycling (Y3) • Finite Elements for Full-scale Engineering Problems (Y3) • Professional Engineering Studies (Y4) • ~~Integrated Building Design (Y4)~~ • ~~Building and Infrastructure Information Modelling (Y4)~~ • ~~Dynamics (Y4)~~ • ~~Soil and Groundwater Chemistry (Y4)~~ • ~~Industrial Practice (Y4)~~ • Renewable Energy Design (Y4) • Flood Design (Y4) • Steel Structures (Y4) • Advanced Structural Mechanics (Y4) • FE Theory and Practice (Y4) • Design Feasibility (Y4) • Applied Numerical Methods in Engineering (Y4) • Coastal and Estuarine Engineering (Y4) • Soil Mechanics (Y4) • Structural Engineering (Y4) • Fundamentals of Nanomechanics (Y4) • Sediment Transport Dynamics (Y4) • ~~Environmental Building Studies (Y4)~~ • ~~Environmental Fluid Mechanics (Y4)~~ • ~~Big Data and AI in Civil Engineering (Y4)~~	

12.4 South Europe

12.4.1 Italy – DTTN

Survey on skill gaps, training needs and learning outcomes as perceived by the construction sector workers – Italian demo results

Introduction to the survey

The present survey has been conducted as part of DTTN work in order to inform INSTRUCT D2.3, intended as a living document to be updated periodically to collect inputs from the different demos across Europe.

The main purpose of the survey was to collect specific data, insights and perception from Italian construction sector workers around key topics addressed in D2.3, namely skill gaps, training needs and learning outcomes.

To do so, the survey was partially developed around few selected questions from the "1st stage methodology" originally proposed by Cardiff University team to stimulate the debate around the aforementioned topics over the INSTRUCT trainings and events performed in each national demonstration.

The survey has been conducted online via Microsoft Forms from December 22nd 2022 to January 14th 2023. It was disseminated through online channels (email and newsletter) to 2 different target groups:

1. Construction sector's practitioners, workers and technicians who took part in the INSTRUCT Italian demo events in 2022 and gave their consent to be further contacted by DTTN for activities related to INSTRUCT;
2. The so called "ARCA network" of DTTN, mainly consisting of professionals from the timber construction sector who support the ARCA system and/or became certified workers under the ARCA training center managed by DTTN.

Structure and questions of the survey

The survey is developed around 4 parts:

1. Introduction: purpose of the survey in the context of the INSTRUCT project, description of the target group and focus of the technical domain (energy efficiency and sustainability in the construction sector);
2. Ethics;
3. General information of the respondent;
4. Skill gaps, training needs and learning outcomes according to the respondent.

The survey was written and handed out in Italian. What follows is the English transcript of the entire survey.

Introduction

Habitech - Distretto Tecnologico Trentino S.c. a r.l. SB - intends to involve you in the demonstration activities conducted in Italy and other European countries as part of the INSTRUCT project (Grant Agreement No. 894756).

The INSTRUCT project is currently investigating the link between training and energy efficiency in buildings with the aim of proposing a comprehensive operational framework capable of preparing a new generation of technicians and professionals in the sector.
This consultation focuses on the issues of skill gaps, training needs, and learning outcomes and intends to analyze how they are perceived and experienced by construction professionals, with particular reference to the areas of energy efficiency and sustainability in construction.
The results of this consultation will inform, in aggregate and anonymously, the research activities currently underway within the project.
For more information on INSTRUCT: https://instructproject.eu/

Informed consent

1. This consultation is conducted by Habitech - Distretto Tecnologico Trentino S.c. a r.l. SB - as a partner in the European project INSTRUCT (Grant Agreement No. 894756).

We invite you to participate in this survey as a professional, technician or practicioner in the building sector in Italy.
Your participation in this survey is voluntary. If you decide to participate, you will still be able to stop filling out the form at any time. If you decide not to participate or stop filling in, there will be any penalty.
To participate in the research you will need to fill out the following online form, which will take about 5 minutes of your time. Your answers will be confidential and no data will be collected that can identify you. The results of this study will be used for research purposes only and may be shared in aggregate and anonymous form with other INSTRUCT project partners and/or within project reporting.
If you have any questions about this consultation please contact Marcello Curci, EU Project Manager at Habitech, at the following email address: marcello.curci@dttn.it
By clicking "I agree" you declare that:
- I have read this notice
- To voluntarily participate in the consultation
- Be at least 18 years old
If you do not wish to participate in the consultation, please decline by clicking "I do not consent".

General information

2. Gender: a) M b) F c) Other [Mandatory question]

3. What's your age group? [Mandatory question]
   a) 18-30
   b) 31-40
   c) 41-50
   d) 51-60
   e) 60+

4. What's your role in the construction value chain? [Multiple choices possible, mandatory question]

a) Designer
b) Construction company
c) Producer of building components/materials
d) Installer
e) Energy assessor and certifier
f) Energy efficiency and sustainability consultant
g) Building/condominium manager
h) Other

Skill gaps, training needs, learning outcomes

5. How often have you faced skills gaps in the implementation/management of sustainable and/or energy efficiency interventions? [Single choice possible, mandatory question]

[Never; Rarely; Occasionally; Often; Very often]

6. Could you please elaborate more on these skill gaps and the ways in which they are usually addressed in construction projects? [Optional question]

[Open question]

7. How often have you relied on training to fill skill gaps, improving your skills or those of your staff? [Single choice possible, mandatory question]

[Never; Rarely; Occasionally; Often; Very often]

8. Are you satisfied with the learning outcomes reached personally or by your staff? [Single choice possible, mandatory question]

[Not at all; Little; Average; Much; Very much]

9. What are the learning outcomes acquired by your staff which helped address the above skill gaps? What are the skills (use of tools), Knowledge (know-how of the content and theory), or autonomy/responsibility (ability to act at task level and apply skills and competence) acquired?

[Open question, optional]

10. Has the process of reducing energy skill gaps increased the profitability of your organization? [Mandatory question]

Yes/No

11. Has the process of reducing energy skill gaps and energy skills increased the added value of your organization? [Mandatory question]

Yes/No

Results of the survey

The sample of the survey is composed by **118 respondents**. 111 agreed to participate and completed it, whereas 7 decided to decline it and not to proceed with filling the form.

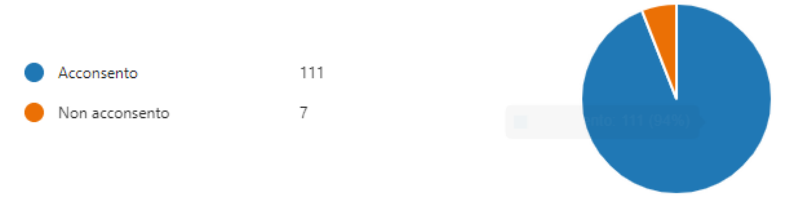

Figure 1 Number of respondents who agree and decline to participate in the survey.

86% of the respondents declared male, 14% female.

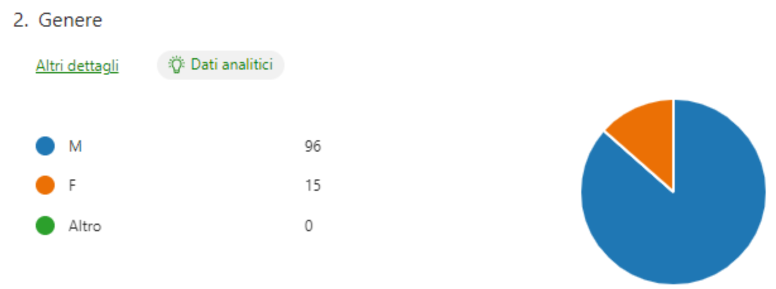

Figure 2 Number of respondents by gender.

The respondents were sorted by the following age groups: 18-30 (3%); 31-40 (8%); 41-50 (24%); 51-60 (41%); 60+ (24%)

Figure 3 Number of respondents by age group.

Question 4 concerned the role in the construction value chain and multiple choices were possible. The most indicated role was "designer" by far. The "other" option was selected 11 times and the respondents indicated the following additional roles not included in the survey:

- BIM consultant
- Maintenance, Construction Work Supervisor, building and grid designer
- Agricultural company administrator
- Appraiser (2)
- Certified real estate assessor
- Public entity
- Timber expert
- PhD candidate in architecture technology
- Construction work technician
- Designer and efficiency manager

Figure 4 Respondents sorted by roles in the construction value chain.

Question 5 on the frequency of skill gaps when implementing/managing EE and/or sustainability interventions obtained the following responses by percentage:

- Never (0,9%)
- Rarely (3,6%)
- Occasionally (34,2%)
- Often (55%)
- Very often (6,3%)

Figure 5 Responses on skill gaps frequency ordered by a "Never" – "Very often" scale.

Question 6 – which was an open, voluntary question to respond – collected 73 responses. 57 of them have been summarized in the following 5 clusters, whereas the remaining were considered not relevant:

- Low level of knowledge on design techniques/methodologies, innovative materials, technologies, and components, as well as of advanced management procedures in the construction projects (11 responses)
- Low level of knowledge concerning regulations and legal aspects, combined with frequent changes of laws themselves by regulation authorities, which worsen the ability of workers to properly inform and upskill (6 responses)
- Low level of communication and coordination among construction workers/professionals at different levels in the value chain. In addition, there is a lack of holistic approach, together with a low ability to be multidisciplinary (16 responses)
- Lack of basic training, combined with low willingness to upskill. Technical knowledge and experience not in line with the specific activities to be performed (18 responses)
- Low level of knowledge and/or communication to the end-user on cost-effectiveness of energy efficiency interventions (6 responses)

Question 7 on the frequency of relying on training to fill a skill gap reported the following responses in percentage:

- Never (0,9%)
- Rarely (2,7%)
- Occasionally (22,5%)
- Often (55%)
- Very often (18,9%)

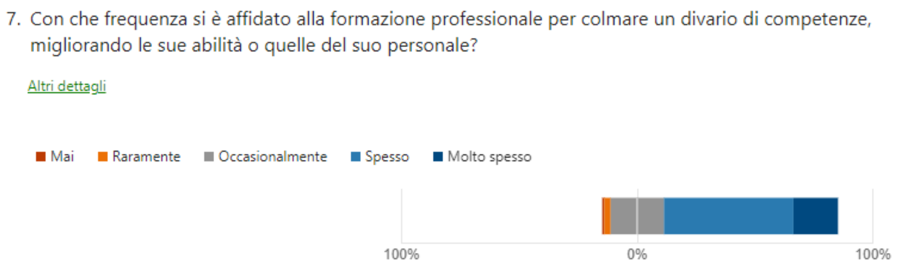

Figure 6 Responses concerning relying on training to face skill gaps, ordered by a "Never" – "Very often" scale.

Question 8 related to the degree of satisfaction of learning outcomes reported the following responses in percentage:

- Not at all (1,8%)
- Little (9%)
- Average (56,8%)
- Much satisfied (29,7%)
- Very much satisfied (2,7%)

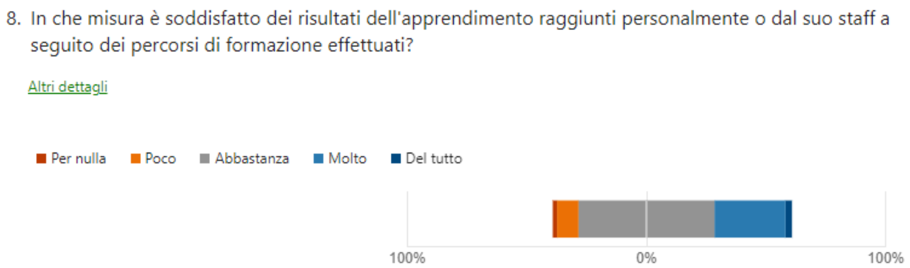

Figure 7 Responses concerning the degree of satisfaction on learning outcomes acquired from "Not at all" to "Very much".

Question 9 on the learning outcomes acquired individually or by the whole staff reported a total of 69 responses. Considering the great diversity of them, it was not possible to group them in consistent clusters. Furthermore, since most of them did not get the focus of the question, only 13 responses were considered relevant for the investigation and listed as follows:

- Enlarge the range of the available technical solutions to solve possible issues
- Knowledge on building components and how they must be used
- Knowledge on physical properties of materials and their correct use to determine an envelope's stratigraphy. Detailed knowledge of systems functioning and interconnections
- Knowledge on general issues concerning the design stage and on those addressed by other professionals both in the design and implementation phase
- Technical physics knowledge, air-tightness principles, and materials knowledge along with BIM use to be able to interact organically with other professionals

- Theoretical and practical knowledge aiming to understand use and limits of technologies
- Ability to use different software; contract management methodologies; specific regulations such has security and fire prevention
- Ability to use software and tools; knowledge on new construction methodologies
- Technical and theoretical knowledge; ability to act at the task level and to perform problem-solving
- Improved knowledge and increased ability to interact with others in the design-management process of the building intervention
- Ability to respond to needs related to problem solving at the construction site, with particular reference to the ability to "elaborate" the answer, without relying on the traditional channels (main sales networks of manufacturers/dealers of building materials, technical offices of commercial companies, etc.) but evaluating from time to time the appropriate solution
- Conscious use of computational software; understanding of physical phenomena and conscious adoption of technically feasible solutions
- Use of specific software and training in the use of innovative tools

Question 10 and 11 were respectively focused on the profitability and added value derived from training and reported the following results:
Profitability:
- Yes (57%)
- No 43%)

Added value for the organization:
- Yes (76%)
- No (24%)

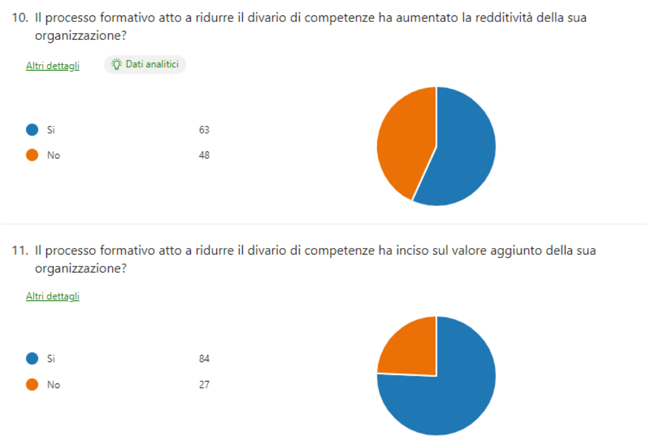

Figure 8 Impact of training on profitability and added value of an organization from the construction sector.

12.1.2 Finland – VTT

R2M had a supportive role here, in liaison with DTTN.

12.5 East Europe

12.5.1 EnEffect – Bulgaria

SUMMARY

As it is outlined in the guidelines for T2.3 of the INSTRUCT project, several interviews have been conducted with representatives from educational (higher and vocational) establishments in Bulgaria to determine the rate of adoption in the recent years of topics on energy sustainability in construction and nearly energy zero buildings (NZEB) into teaching materials. The meetings were held in one-on-one sessions in which questions were posed to guide the conversation and to derive conclusions about the success of systematic change in the educational system and in particular the relevance of ULOs, defined within the INSTURCT qualification framework for individual professions.

During the discussions, potential for improvement has been identified in the development of numerous subjects on energy efficiency, passive house design and circularity economy for the occupational field of architects and civil engineers. At the same time, obstacles for wholesome integration of topics on energy efficient design and digitalization into educational content have been pointed out and several solutions have been considered. In the course of the interview teaching professionals were sharing personal and professional experience to give an insight into the state of matter and detailed answers are described below.

What is the tendency of integration of topics prioritized in the INTSTRUCT project in the educational system and what is still missing?

Through the global development of the construction sector and with the introduction of new energy policies in the EU more and more subjects on sustainable buildings are entering the educational content at universities as addition to existing curricula of some engineering disciplines. Examples conclude advancement of topics, regarding activities described in LO1 to LO4 from the country- specific qualification framework for architectural and structural design roles. Courses on sustainable building design have been equally distributed between the bachelor and master programmes to match and to create balance in the content that is taught. It is noted that there *is currently more engagement with sustainable design in the faculty of architecture in comparison to civil engineering,* which is evidenced in the selection of courses and electives in the study plan. Subjects include energy efficiency, circular economy in construction and effective resource management. *Unfortunately, overall progress to introduce more concepts of innovative and sustainable methods of building has been very slow due to reluctancy of teaching staff to include new subjects which do not easily match the content of their existing programmes.*

It seems that it is easier to offer elective courses, which present alternative methods of building. In this way, ULOs from the qualification framework could be made more accessible through development of such courses. Additionally, individual tasks from LO5, 6 and 7 could be adjusted into existing teaching materials for planning and management of buildings without disrupting the actual structure of the course. Respectively, LO1 to LO4 and specifically tasks related to application of digital tools into the design phase could be added to current courses on sustainability.

In comparison, the topic of digitalization and use of BIM tools, supporting planning and design has been almost completely integrated into the teaching process and students have been exclusively using digital tools to prepare and present their projects. An announcement on the webpage of the university shows that a whole new master programme on building management with BIM for students of architecture is being offered, starting this semester. What is still missing is a coherent subject which focuses on applicability of BIM concepts in coordinating building energy performance optimization as foreseen in the qualification framework of the INSTRUCT project. However, under the given circumstances an opportunity exists for inclusion of activities under LO5 to LO8 to already existing courses. Therefore, this aspect of building planning should be better communicated to teachers to promote the benefits of managing building life cycle information through digital tools.

While advancement at university is marked by a slow and complex way of updating existing courses, at the professional high school for architecture and civil engineering in the city of Pazardzhik things are looking differently. Global tendencies in construction have been followed and accommodated into study plans. The director of the school has engaged her personally with the modification of teaching materials and proactive inclusion of topics such as nearly energy zero buildings and passive houses into the subjects being taught. The intention has been realized through active involvement in international and local projects, aiming to stimulate the exchange of information and knowledge among teaching bodies across Europe.

There is a general agreement that more about NZEB, circularity, and digitalization in construction should be included into teaching materials for students for all engineering disciplines. The country specific qualification framework of ULOs on sustainable planning with BIM offers a model for integration. However, commitment by teaching staff to deal with the introduction of new topics or to drive research and development has been seriously missing. Subsequently, that has led to the absence of a curriculum on sustainable building methods being taught to university students.

Which are the main factors influencing integration of the qualification framework, developed under the INSTRUCT project into the educational system?

Representatives from the university of architecture, civil engineering and geodesy in Sofia underline the difficult path to changing course materials as having significant effect on level of integration of new subjects. The reason being complexity of decision-making process in the hierarchy of the university administration and stubbornness displayed by some of the older generation teachers and people in position. This makes the introduction of topics on sustainability much harder since the ones who would like to include such materials do not meet the support of their colleagues or the management.

It is no surprise then, that the construction market in Bulgaria has not acknowledged the need for skilled workforce in energy sustainability and has not been willing to invest in it. As such, the role of active professionals in the construction industry and their level of engagement with innovation in planning and building, plays an essential role for the requirements for introduction of specific skills in the education system. The fact that there is no public financial support for the improvement of higher education in that sense only worsens the situation.

At the same time, collaboration with international education facilities and projects has shown great success in the integration of new skills and knowledge in planning energy efficient buildings among students at the professional gymnasium in Pazardzhik. As a result, students from lower level of vocational training come out prepared and seeking opportunities for further development in the area of sustainability.

What could be done more to stimulate better understanding among stakeholders in building industry for the need of qualification on energy optimization and sustainability in construction?

Change in the management policies at the university has been proposed in line with the arguments mentioned in the previous point to allow for a more flexible and consistent transformation of the educational content. This could be coupled with training of the teaching staff on topics regarded in the

INSTRUCT qualification framework and to create conditions for proactive engagement with the design of new subjects and programmes. Since the framework offers a practical approach to building design and procurement, more functional approach in the form of workshops, case studies and demonstrations of applicability could stimulate the process of integration. An important aspect in that sense is the involvement of companies as a guide and initiator of research and workshops, which could provide necessary support for development of such initiatives and could create a much-desired exchange of practical and theoretical knowledge to drive innovation on both sides.

CONCLUSION

The inclusion of qualifications and **ULOs,** determined in the INSTRUCT framework, into higher and vocational education has been marked by difficulties and slow progress. While educational facilities should be acting as drivers of innovation and as contributors to scientific and economic development on national scale, they should also actively seek out ways to contribute to creating conditions for that to happen. Raising awareness among teaching staff and general academia about topics, described in the qualification framework could spark a positive change in attitude and stimulate integration of subjects into new and existing courses. Creating collaboration with active stakeholders and presenting more practical ways of application of the INSTRUCT **ULOs** could further assist creation of functional relationships that expand into productive teaching processes that prepare for future of buildings and inspire sustainable attitude.

Survey Results

-What is your role in the project value chain? (Roles)
-How could you do you enhance needed new skills or competence at the project level on energy-efficient and sustainable interventions? QUESTION 1 Do you think you have the necessary skills or competencies to evaluate energy efficient and sustainable solutions at project level?
-Do you feel you have enough methods to require skills and competence (like verifying skills during tendering or having a development phase in the procurement process)? QUESTION 2
-What type of methods do you know or have used? QUESTION 3
-Do you feel you need more training on the requirements methods for service providers about the skills and competence in energy-efficient and sustainable interventions? QUESTION 4

ASSESSMENT OF THE TRAINING NEEDS OF INSTRUCT MAIN TARGET GROUPS FOR THE BULGARIAN PILOT CASES

Report under WP2 of the INSTRUCT PROJECT
Author: EnEffect

Among the group of participants asked to fill in the questionnaire, there were representatives from six different stakeholder groups, namely:

- Public officials
- Employees at financial institutions
- Members of professional associations
- Teachers
- Energy consultants
- Producers and distributors of building materials and components

The general impression from all groups is that there is already knowledge on requirements for energy efficiency and how it could be successfully applied in the process of evaluation of project design. To the question whether they feel qualified to assess energy efficient solutions, most of the participants replied with 'Yes' (fig. 1).

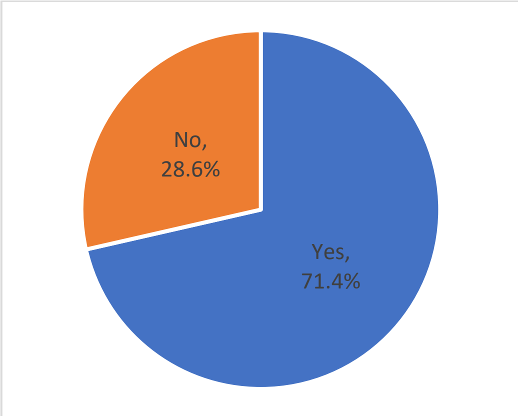

Fig. 1 More than half of the respondents believe they possess enough expertise to evaluate energy efficiency of project proposals.

Among them teachers and energy consultants appear best trained to perform such evaluations, while producers of building components and representatives from financial institutions feel less prepared to deliver accordingly (fig. 2). The high score for public officials is considered as slightly surprising; however, it is explained with the involvement of official present at dedicated events, for whom the assessment of investment projects is a part of their daily activities.

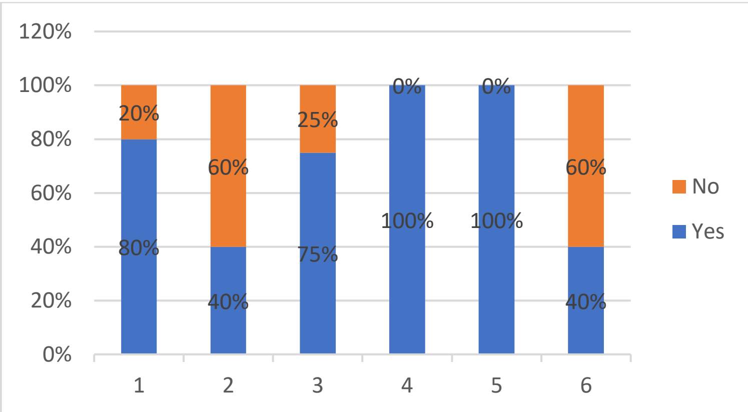

Fig. 2: Self-assessment of competence to deliver energy efficiency evaluations per target group: 1. Public officials 2. Employees at financial institutions 3. Members of professional associations 4. Teachers 5. Energy consultants 6. Producers and distributors of building materials

Participants are also familiar with the most common tools and methods for quality checks such as energy performance surveys and corresponding energy certificates. This is mostly valid for public officials and carriers of knowledge on energy efficiency (teachers, energy consultants and professionals), while producers are mainly involved with trainings on the building site. International standards for energy certification (LEED, BREEAM, Passive House...etc.) are being recognized among all groups, as well as the demand for special qualifications for people working on public projects.

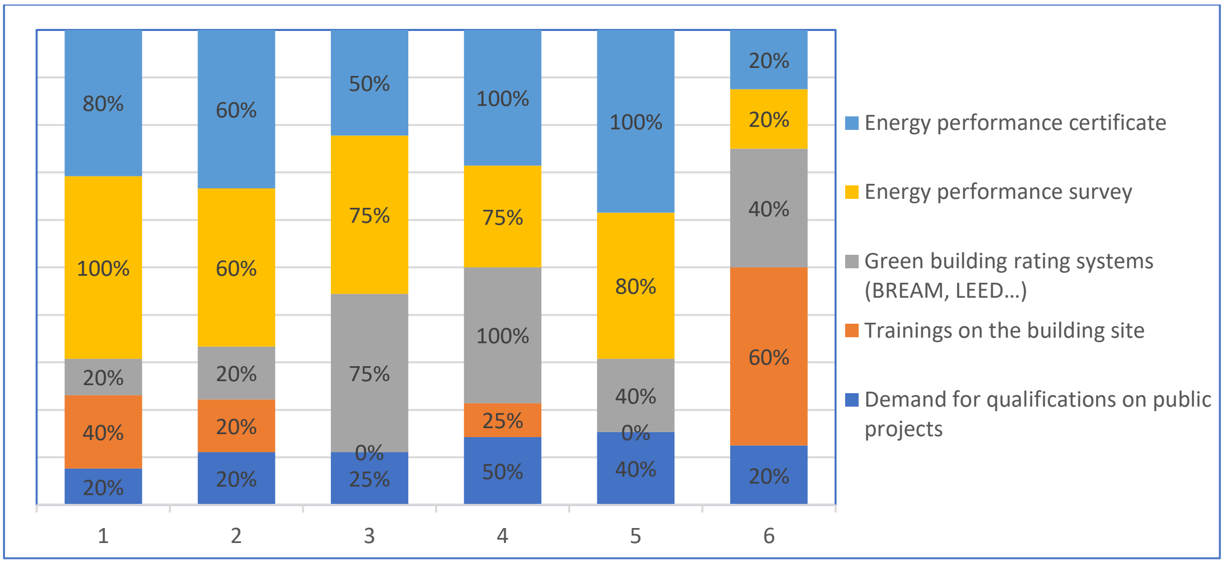

Fig. 3. Familiarity with quality assurance instruments and methods by target group: 1.Municipal workers 2. Employees at financial institutions 3. Members of professional associations 4. Teachers 5. Energy consultants 6. Producers and distributors of building materials

The presented results imply a positive direction in the development of qualified knowledge in energy efficiency among stakeholders and respectively in the delivery of quality sustainable projects. Nevertheless, participants can identify the personal need for additional knowledge on management of energy efficiency projects as well as appropriate tools and methods for evaluation (fig. 4).

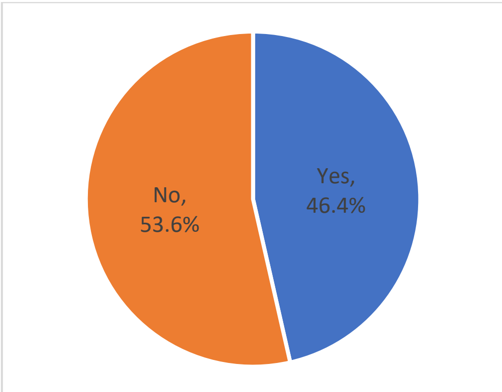

Fig. 4 *More than half of the respondents believe they do not possess enough tools and methods to inquire about energy efficiency.*

Latest discussions on the matter revolve around current national legislation and rules for public procurement, which have not been harmonized to support the process of improving energy efficiency. It makes it difficult to operate in such environment, where roles and responsibilities are not clearly defined and there is no system approach. As a result, stakeholders experience stronger need for increased expertise and additional skills to manage in the given situation (fig. 5). Developing a structured strategy and formulating distinct goals for sustainable building environment would enable a streamline of shared knowledge and experience among stakeholders.

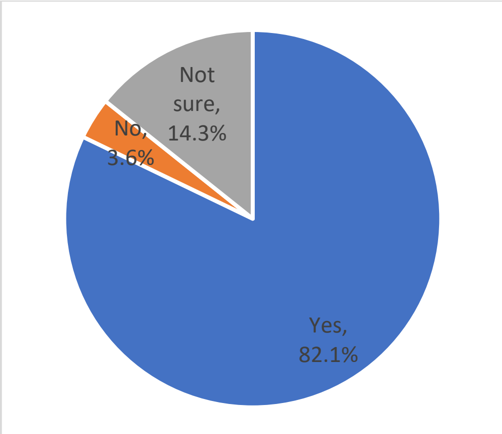

Fig. 5 *Almost all participants are sure that they still need additional trainings to gain sufficient competence in the assessment of energy efficiency of projects*

After completion of the questionnaire, brief group discussions were conducted with 4 of the pre-selected target groups:

- Public officials
- Members of professional associations
- Energy consultants
- Producers and distributors of building materials and components

The public officials were unanimously confident in their understanding of the energy audits, energy performance certificates, component of design projects related to energy efficiency, and the supporting documentation, emphasizing that this is a part of their daily activities. They pointed out that the quality of these services is not at the expected level, which hampers their activities in the actual implementation of the projects. In their appreciation, the reasons for this issue are both in the insufficient professional qualities of the service providers, and in the rules of the procurement process, which is often based on lowest cost criteria and does not allow municipalities and other public procures to select better quality services at higher price.

"In any case, we should invest heavily in training and education. And not only for municipal officials, but also, or even mostly, for auditors and designers" (a city mayor during a group discussion)

The training opportunities for public officials are deemed satisfactory in most of the traditional areas, but as regards more innovative concepts like e.g. climate adaptation, they are still scarce and not accessible in remote cities. It was however inferred that *training is only making sense if its outputs are directly related to the daily activities of the experts, as the example was given with training courses on energy audits vs. training on nZEB, the later still not being a part of the national legislation, which makes many of the training contents and results of the training courses obsolete*. The training opportunities in general are however valued, as among other benefits, they improve the understanding of the trends at EU level, which helps the implementation of international projects. When pressed into the topic, the respondents agreed that the courses they have visited helped them in the assessment of the energy audits and design documentation, as well as in the investors' control over the construction activities. It was also mentioned that the INSTRUCT-supported model for public procurement has been implemented and the on-site training is already in planning phase, which should help bringing the theory to the practice at the construction site.

The discussions with the members of the professional associations were less dynamic and even more focused on their core activities, as the impression was that, surprisingly, the respondents were seemingly not aware on the actual level of the energy efficiency-related knowledge and skills on the construction market. They pointed out on the legal obligation of the companies to provide experts with certain (non-EE related) professional qualification and insisted that they depend on the national qualification system to provide the necessary competences. When confronted with the need to update the knowledge and skills of the working force already active on the labour market due to the changing regulations, they suggested that *the training on EE should become mandatory, as otherwise it would be very difficult to convince the employers.*

"Look at the mandatory health and safety training – we are doing hundreds of courses every year. If it is that important, the same approach should be applied to energy efficiency and we as Chamber will be providing that to our members as well" (a professional chamber official working in the training and education section)

The officials from the professional chambers were not able to comment on specific learning outcomes or on the impact of EE training on their members. However, they insisted that the knowledge and skill should be raised along the whole construction sector value chain, as the construction work depends heavily on the demands of the investor and the quality of the design project; according to them, if the design project includes clear details on energy efficiency, in most of the cases the contractors would find out how to execute it properly. They also insisted on the importance of the state incentives for the increase of the interest to energy efficiency, considering this approach as key for the development of the market.

The energy consultants (providers of energy audits and energy performance certificates) were expectedly confident on their adeptness working with both national and international calculation and evaluation instruments, while at the same time pointing out at deficiencies in the national system as e.g. the lack of developed/approved methodologies to approach certain issues.

"We still don't have any official methodology to calculate the cooling demand, and believe it or not, the energy demand for domestic hot water is calculated on the basis of the total capacity of the pipes. We don't have any standard values for the electrical equipment as well. We need to improve our methodology because it is not suited to the new building norms, and the problem will only grow when we move to new issues as smartness, e-mobility, grid connectivity" (certified energy auditor at group discussion).

It was noted that while the qualification framework is very well described and adequately ambitious, there haven't been certification courses for energy auditors for nearly 10 years, which prevents the natural regeneration of the profession. Thus, the main source of information is the practical work on the market and the established relation with product suppliers, which provide technical data about their solutions. The knowledge gaps are perceived not that much as a problem for the qualified experts, but the lack of enough experts on the market is definitely perceived as a market barrier.

The interviewed group of auditors relies on training under various international projects and following the ISO:52000 group of standards to improve its knowledge and skills, and this is perceived as relatively important as it helps them to respond to demands of various clients which expect service aligned to the international norms and standards. There is no single output of trainings that can be identified as particularly important, as in their perspective, the integrated approach is always pursued during their work. The use of instruments for energy modelling of the buildings was briefly discussed, but the prevailing attitude was that the national calculation software is used in the majority of the cases, while only the biggest – and mostly the foreign - investors apply more integrated BIM approaches and request energy consultancy services to be based on them, so they are still not the mainstream practice. It was however inferred that the competence in working with various methodologies and certification systems improves the competitiveness, and this is state as one potential area of further training.

The producers and distributors of building materials and components were the only group that demonstrated experience with on-site training and education, insisting that in many cases – and especially for larger projects – they go directly to the construction site to explain and teach the contractor for the correct installation for the product or the system. This is by far the biggest concern for them, as they perceive the overall skills and knowledge of the construction workers as critically insufficient, which reflects on their business as improper installation of their products leads to poor market reputation. They also reflected on their experience in training designers and consultants, as it was declared that it becomes more and more problematic to organize such trainings as the market is very busy and is driven by the low-price offers – which is obviously not a stimulus for the different actors to improve their qualification. The services offered have gone so far that the biggest manufacturers maintain specific units to consult the designers on the individual projects which they have, when they have them.

"It used to be easier before – designers came to company's events because there was no other source of information. Now they think they can find everything on the internet when they need it and don't want to waste time for training. You can only get them if you offer them some wine, good food, party time, and squeeze the lecture in 30 minutes. At the end they don't learn anything and stay at the same level, but the problem is that the market allows it because the clients don't know that they can get better services" (representative of local professional chamber in group discussion with product manufacturers)

This group (*producers and distributors of building materials and components*) was not that confident regarding the use of different calculation and modelling software and tools, which is perceived as normal due to their limited connection with their everyday activities (the interviewed were mostly "front-office" personnel, i.e. traders or marketing experts). They expressed willingness to learn more about these processes as after explanation, they understood their importance for the market positioning of their products. However, they were not able to point out training offers that could offer them such outputs. They receive their knowledge mostly from corporate training and were happy with the training delivered by EnEffect on the specific occasion, as it combined presentations from different value chain actors on a conceptual framework focused on the nZEB design principles. This was reviewed as an unconventional but useful approach.

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