Department of the Built Environment

Version 1.0 april 2024

TU/e

EINDHOVEN UNIVERSITY OF TECHNOLOGY

BACHELOR AUBS COURSE GUIDE

Program 2.0 - After Revision

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MISSION STATEMENT

Department Built Environment

We educate students and we advance knowledge in science and technology from the perspective of the built environment for the benefit of humanity.

We house a unique, broad and inspiring spectrum of technology and engineering, design and human behavior disciplines in the realm of the built environment, on all scales and with world-class facilities. We integrate these to address urgent societal challenges on a systemic level.

We enable our students and scientists to have a meaningful impact on society's pressing issues and to become thought leaders, able to (re)shape the built environment beyond the limits of current imagination, and sustainably in every way.

Strategic Plan 2020-2030 Built Environment

STRATEGIC PRIORITIES

Related to the three strategic choices of TU/e, the department has the following vision:

TALENT

The department strives for scientific excellence in education and research in its disciplines of technology and engineering, human behavior and design in the domain of the built environment. We stimulate our talent explicitly to work together in teams to achieve our departmental ambitions. Team science requires room for differentiation. We want to bring talents together with a different focus regarding research, teaching, impact and leadership, and to benefit from the synergy. All members of the scientific staff are both active in research and in education, be it that the balance may be different for each individual. To enhance our educational programs, including talented scientists in the development and execution thereof is essential. The same applies to defining and carrying out plans to strengthen our research and increase our societal impact. This requires leadership that excels in providing space for the talents of each individual, simultaneously looking at the best interests of the team, and taking into account differences between disciplines, cultures and backgrounds.

COOPERATION

The department aims to take a leading role in addressing the complex societal challenges which profoundly affect our built environment. These challenges in the field of energy, inclusiveness and sustainability are characterized by the strong interconnection of many factors. In order to play the leading role, we will work together with partners on these societal challenges in research and education through thematic programs over a number of years.

Teamwork and cooperation are therefore the key to success. To encourage collaboration, we build, maintain and strengthen internal networks, and we incorporate societal challenges in research and project education. Our staff is encouraged to engage actively with the TU/e institutes EAISI and EIRES, with the universities in the alliance of Utrecht University, Wageningen University and Eindhoven University, with the 4TU federation partners and with the public partners and industry in the Urban Development Initiative (UDI). Finally, we build stronger connections with our alumni. This calls for leadership that connects through communication and is highly visible.

RESILIENCE

The development of talent, and the ambition to have true impact on our built environment by cooperating on societal issues, requires a highly professional and resilient community. This also calls for well-organized education and research management teams, and professional support for both research and education. In terms of leadership, both the ability to build communities and the flexibility to rethink the way we use our Vertigo building and our experimental facilities are indispensable.

CORE VALUES

- **Collaboration,** connection and integrality.
- A **safe and open** working environment , taking care and concern for each other.
- **Autonomy**, room for everyone to excel.
- **Responsibility** for our own work, department, university and society.
- **Equality, openness and transparenc**y with room for dialogue and critical debate.
- **Integrity** and **reliability**

BACHELOR COLLEGE

The bachelor program AUBS is part of the TU/e Bachelor College. Within the Bachelor College, you can create your own personal study program based on your interests and ambitions. Combine courses of different subjects to get a broad orientation, or dive into specific subjects! This is the setup of the program:

Core program	125 credits
Elective courses	45 credits
Impact of Technology (ITEC) program	10 credits

In total, the three-year program is worth 180 credits (ECTS). The ITEC courses are given to all future engineers at the TU/e. Core courses are mandatory courses within the field of AUBS.

AUBS

The Built Environment is a very broad field of study. The first year of the bachelor AUBS is designed to help you explore four different BE tracks:

AUDE Architectural Urban Design and Engineering

USRE Urban Systems and Real Estate

BPS Building Physics & Services

SED Structural Design

Throughout the bachelor program, the Core courses will teach you the fundamentals for every track. In the first year you will become familiar with all profiles by doing projects and career orientation activities within the curriculum. This will help you answer the following options:
- What do I like?
- What am I good at?
- What career do I see for myself?

At the end of year 1 you will start specializing by choosing your main track using electives to build your own unique profile.

Good to know:

Every course is worth 5 credits (ECTS), with the exception of the projects in year 3 which are both worth 10 ECTS .

You need to obtain a minimum of 45 out of the 60 ECTS in the first year to obtain a positive BSA (Binding Study Advice).

The Program and Examination Regulations (OER/PER) contains detailed information on the program, regulations, examinations, guidelines (incl. BSA) and the Cum Laude classification. (educationguide.tue.nl/programs/bachelor-college/majors/architecture-urbanism-and-building-sciences/regulations)

You have to register yourself for the courses, via OSIRIS. Every course has its own timeslot.

The TU/engineer

At the TU/e you will receive a broad education. The Bachelor College's courses – but also the option to choose courses beyond your own discipline – allows you to understand and collaborate with people from different backgrounds. As a TU/engineer you will learn essential skills that you need throughout your professional career, and you will learn how to translate knowledge and expertise into useful, innovative and responsible solutions for society.

PRACTICAL INFORMATION

Your development at our university starts with creating your own course program, but did you know there is a lot more to choose from? Invest in your future and explore the great offer of extra-curricular activities:

CHEOPS
Study association of the Built Environment

- The Department of the Built Environment has the largest number of study associations at the TU/e. CHEOPS and its sub-associations organize workshops, excursions, lectures and leisure activities. Join a committee to meet new people, learn new skills, and have fun! (cheops.cc)

Studium Generale TU/e

- Broaden your horizon at Studium Generale: lectures, debates, concerts, theatre, movies and more! (https://studiumgenerale-eindhoven.nl/en/)

- Find career related activities and workshops on MyFuture (myfuture.tue.nl)
- Enjoy great sports facilities at the TU/e. Choose from 70 sports at the Student Sport Centre Eindhoven (https://ssceindhoven.tue.nl/en/)
- The Digital Exhibition platform exhibits students' work from the Built Environment department of Eindhoven University of Technology (TU/e),(https://digitalexhibition.arch.tue.nl/)

- Several career orientation activities will be organized during your Bachelor program to help you make the best choices within your program. For example the Alumni Night and the BAU excursions. The Alumni Night will be on campus and is a great opportunity to ask our alumni all about their careers and the steps they took to get where they are now. During the BAU excursions you will visit various companies to learn more about the work field. We will publish information about career orientation and other education related activities via Canvas 7IBP1BE (year 1), 7IBP2BE (year 2) and 7IBP3BE (year 3). Keep an eye on these pages!

Coaching and advice

As a TU/e student, you are responsible for your own study progress and we expect a pro-active attitude. Of course, we will help you when needed. All first year students have a personal student mentor. They will help you with practical issues (such as registering for courses and exams), and gives tips for studying, planning etc. AUBS also provides teacher coaches. You can talk to the teacher coach (or in the specialization of your preference.In case you have questions regarding the curriculum or your study progress, please contact the Education & Student Affairs Office. An appointment with the academic advisor, for instance to discuss any personal circumstances, can be made online (educationguide.tue.nl/guidance-and-development/who-to-contact/academic-advisor).

To-do list

- Update your planning in the PlanApp! (osirisplanapp.tue.nl) Verify if you have planned all your courses.
- Create your personal timetable (via mytimetable.tue.nl/schedule). Add courses to find out the schedule of your lectures and projects.
- Check the inbox of your TU/e email. Make sure to read your email daily, it is the main means of communication at our university. Access your email via webmail.tue.nl.
- Check the MyFuture-page under career orientation on the education guide.
- Install the multifunctional printer and the plotter (tuenl.sharepoint.com/sites/intranet-built-environment/SitePages/facility-services.aspx).
- Get familiar with the complete AUBS course program at the Education Guide (educationguide.tue.nl/programs/bachelor-college/majors/architecture-urbanism-and-building-sciences)
- Consider purchasing Adobe Creative Cloud Student (surfspot.nl/software).

More information

Education & Student Affairs Office
(Built Environment)
Vertigo 2.12
esa.be@tue.nl

And check out our webpages

- Academic year agenda
- Regulations (PER!)
- OSIRIS
- CANVAS
- Intranet

We need your help to improve our education!

Please fill in our course evaluations and send suggestions for improvements and complaints to the Education Coordinator (education.coordinator.BE@tue.nl). Complaints on exams can be sent to the Examination Committee (examination.committee.be@tue.nl).

EDUCATION

The goal of our education is to educate students who are capable of achieving a greater impact on complex and cross-disciplinary challenges within the built environment. Our education has traditionally been characterized by a mix of lectures and project work. Both forms of education are undergoing change. Various forms of blended education are replacing the 'oral lectures only' model. Project work will gradually be developed into fully-fledged Challenge Based Learning with complex challenges, for which we will structurally call upon the help of hybrid lecturers originating from the alumni network.

After the first-year with its common ground students will specialize in one of the disciplines within Architecture, Urban Studies and the Building Sciences they can use their elective package to give further shape to their study program.

The aim is to educate engineers for the future, who can operate across disciplines (т or π shaped engineers) based on common ground as well as an expertise in multidisciplinary collaboration, and offering personal learning paths through tracks and profiles.

DEPARTMENTAL DIRECTIVES

The new programm should be:

- Workable
- Study-able
- Affordable
- Provide maximum freedom of choice for students - This is reflected in the new educational program which caters for three different profiles: **diggers, binders & climbers**.

  Diggers are Tau-shaped engineers (with a long vertical bar for the T) -their track and elective profile are fully dedicated to disciplinary specialization.

  Binders are Tau-shaped engineers (with a wide cross-bar for the T) -their track profile is complemented with a choice of electives geared to a Thematic Learning Area.

  Climbers are Pi-shaped engineers - experts in one discipline but with their other leg in another discipline forming their own unique profile.

The profiles are only indicative. We encourage self-directed learning and students are completely free to choose their own electives as long as these fit in their timetable and do not overlap with other (core) courses of their chosen track.

Diggers

Students who want to dive deep into their discipline, each unit will design a track with electives to accommodte this profile.

Binders

Students who want to combine their disciplinary knowledge with a commitment to one or more of the societal challenges we face (Thematic Learning Areas). Students can choose electives on, for example, sustainability, from other courses at the faculty, at other faculties or other universities.

Climber

Students who want to create a unique profile for themselves by combining their chose track with courses from another track. These students might be preparing themselves to do a double major.

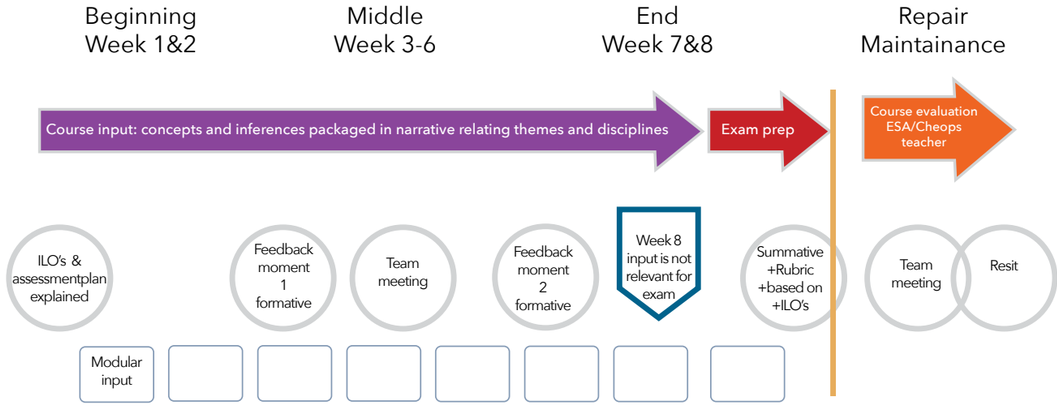
CURRICULUM COHERENCE

1. The **concepts, skills and attitudes** we want students to learn in second and third year should be based on the ones taught during first-year. The first year counts as **prerequisite knowledge** for the core courses within all tracks in second year. The connection between all courses ought to be **coordinated** and **made explicit**. Learning lines of concepts, skills and attitudes taught should be reflected and made visible in the contructive alighnment of ILO's, Learning Activities and Assessments
2. Diversity in **work formats** used for the variousl learing activities
3. Diversity and **alignment** regarding **assesment forms and their timing relative to** other courses
4. The curriculum as a whole is **studyable** from student perspective
5. The curriculum is **teachable** in its entirety.

COURSE DIRECTIVES

1. From focus on teaching to **focus on Learning**;(including blended learning and peer feedback as means to an end)
2. **Assessment** for learning, formative and summative, inlcuding 2 feedback moments during the course
3. C**onstructively aligned**: learning activities , assessment and ILO 's are consistent
4. Promote **Sustainable Development Goals**
5. Diverse, safe and inclusive
6. P&PD: **personal & professional development integrated** and assessed
7. Foster **active and self-directed learning**.

OVERVIEW COURSE / PROJECT IN WEEKS DIRECTIVES



COMPETENCIES AND INTENDED LEARNING OUTCOMES FOR PROFESSIONAL AND PERSONAL DEVELOPMENT

Introduction

This chapter contains a catalogue of ILO's relating to the Professional and Personal Development Learning Line.

Creating effective Intended Learning Outcomes (ILOs) is a pivotal step in the design and constructive alignment of any educational programme, including Challenge-Based Learning (CBL) courses. ILOs serve as a roadmap for both educators and students, helping to establish the expectations and goals for a course and forming the basis for a proper constructive alignment between the learning ambitions as expressed in the ILOs, the learning activities performed to achieve them, and the assessment methods employed to test whether students can demonstrate their knowledge, skills, and attitude. Any rubric made to help in the assessment should explicitly start with the ILO to be assessed.

A course may integrate three types of Intended Learning Outcomes:

1. Subject-specific ILOs (S-ILOs)
2. Professional and Personal Development ILOs (P&PD-ILOs)
3. Thematic Learning Area ILOs (TLA-ILOs in so far, they can be distinguished from the Subject-specific ILOs.

LEVELS OF COMPETENCE DEVELOPMENT

The levels are relevant for each competence as a whole and will not be specified for each separate ILO.

I. A student can demonstrate through description, definition, and enumeration an understanding of what the competence entails and is aware of why it is important for the domain of practice by describing and enumerating the reasons for the value placed upon that competence.

II. The student can demonstrate through performance and explanation (see the term 'understanding' in the glossary) competence-related activities under supervision, and effectively communicate how the competence is developed. The ability to explain something means in demonstrable behaviour that a student is able to give valid arguments for adopting an attitude or performing an action and argue for and against certain practices.

III. The student can demonstrate through application and by reflecting upon their development a competence effectively and independently to produce the desired outcomes as well as critically evaluate/ reflect upon their own performance. With this is meant that the student can explore possibilities latent in a situation relevant to that competence and critically evaluate the outcomes of those explorations against criteria that are made explicit.

IV. The student can demonstrate by managing the proper application and development of a competence within a team to produce the desired outcomes. With management is meant the ability to listen to various arguments and then create enough of a support base to implement the best approach.

- Level 1: Describe, define, enumerate, qualify, quantify, translate, denote, being aware.
- Level 2: Perform, apply, explain giving valid arguments, analyse, argue, criticize.
- Level 3: Develop, critically evaluate, justify a decision or opinion with valid arguments, interpret, judge with good reasons, reflect.
- Level 4: Design, manage groups, give feedback with good arguments whilst being sensitive to context, process feedback.

These levels are based on Bloom's taxonomy but also represent a further development of them. We should assume that the more sophisticated levels (in our case III and IV) imply knowledge of the more basic levels I and II. Als such Third year bachelor students should be able to achieve level II or III with regard to each competency chosen by the program and Master students and professionals should manage level IV.

GLOSSARY OF ACTIVITIES DEMONSTRATING LEARNING

Bloom's taxonomy includes many words describing activities that demonstrate learning at some level. In this glossary we have attempted to describe the activity involved. This should help the development of the ILOs as well as the assessment rubrics mirroring them. The ability to say "I know this or that" rests upon the question whether you can say that you understand this or that. As such the most important word in education is the word **understanding**.

To understand something means for the student to be able to:

1. **Describe** what claim is made and what evidence there is for making such a claim.
2. **list and to describe** what other claims must already be in place for the student to make that claim.
3. **Describe** what else the student is committing herself to when making that claim. The student must be able to list and describe the implications of a claim made and use them as reasons for her commitment to that claim.
4. **To list describe** what other ideas are compatible or incompatible with the claim made.
5. **Describe** what the student is entitled to say and do in committing herself to that claim.
6. **Describe** what activities become necessary once one has committed to a claim.
7. **Describe** what outcomes may be expected on the basis of that claim and what guarantees the student can give on the basis of that idea.

To achieve understanding the student is To achieve understanding the student is required to perform a number of activities. In this glossary familiar words are defined in terms of a demonstrable activity.

analysing: the activity of differentiating a whole into its constituent parts and describing the working relationship of those parts in relation to each other and to the whole.

arguing: giving reasons to underpin a certain point of view or adapting a point of view as a result of being given reasons for its weakness or failure.

being aware: having (partial) knowledge of the presence of something and its possible implications.

being irrational: the activity of giving weak or illegitimate reasons to support a point of view or theory.

being rational: the activity of giving strong and valid reasons to support a point of view or theory.

conjecturing: forming an opinion or conclusion on the basis of incomplete information and being aware of this and making that explicit.

criticizing or **critically evaluating**: the activity of evaluating something in relation to some use, purpose or goal.

defining: the activity of describing what something is in terms of what it does.

denoting: the activity of naming, predicating, narrating, describing, portraying, labelling, any application of a symbol of any kind to an object, event, or other instance of it.

designing: assembling possible alternative ways of doing something intentionally in order to achieve some future benefit and deciding on one of the alternatives on the basis of evidence and sound reasoning.

describing: the activity of using words, imagery of numbers to denote, qualify and or quantify something.

developing: exploring possibilities latent in a situation relevant to a competence.

enumerating: see listing.

exemplifying: the activity of showing a property pertaining to the object. (i.e., *showing the construction*)

explaining: the activity of demonstrating understanding regarding something. (See understanding)

expressing: the activity of showing a property that an object does not have but which it acquires through association, i.e., is assigned them through simile, metaphor, and analogy.

giving feedback: information given by something or someone as a result of some action. (please consult the rules for giving feedback)

interpreting: formulating an explanation of some action or other information making the conditions upon which that explanation can be thought of as valid explicit and being open to the possibility that other interpretations are possible.

judging: forming an opinion or conclusion about something on the basis of evidence and good reasoning.

knowing: the activity of possessing an understanding of something. (see understanding

listing: the activity of noting down all relevant constituent parts of some issue or subject.

managing: the ability to listen to various arguments and then create enough of a support base to implement the best approach.

processing: the activity of working through feedback.

qualifying: the activity of ascribing or attributing a property to something.

quantifying: the activity of ascribing a numerical property to something.

reflecting: the activity of thinking carefully (and systematically) about possibilities and opinions, being able to evaluate them through analysis and critique.

thinking; the activity of conceptualising information through analysis and critique thus preparing that information for use in relating the thinker and or her thoughts to her environment.

translating: expressing the sense of something in another medium or language.

Competences

Not all competences are relevant to all disciplines. See this as a menu from which a selection Not all competences are relevant to all disciplines. See this as a menu from which a selection can be made forwhich the coherence and consistency needs to be secured by the educational programs themselves.

To avoid endless repetition all the following points assume the following phrase as their point of departure “At the end of this course the student is able to….”

Professional Competences

This refers to the general competences required to functioning in a professional setting, like communicating (e.g., presenting, writing), planning and organizing, collaborating (including working in international and multidisciplinary teams with different interests and responsibilities), dealing with scientific information, and reflecting. The ILOs include the entry requirements for the Y2Q4 interdisciplinary CBL course, which are described in the Bachelor College Directives:

Collaborating	Communicating	Planning & organizing
The student is able to work with peers towards achieving a common goal within a set period. Accordingly, the student together with the team can come to a division of assigned tasks across the team members. The student can, under supervision, identify how individual competences are used within the team and support the development of competences of team members. The student is able to appropriately give and receive constructive feedback in a group setting. Note: The student is aware that addressing many complex challenges may require collaboration between multiple disciplines.	The student can present her work and discuss ideas orally, in writing and visually. The student can adjust her communication towards interacting with specific target audiences. The student is able to proficiently communicate in English.	The student can, under supervision, translate a common goal into tasks and activities. Accordingly, the student is able to organize their own activities in the context of a team, given constraints (resources, timing, scope). The student is aware of (discipline- specific) tools and methods that support planning.

Each competence can be broken down into specific activities that together form the competence. It is these activities that form the basis of each ILO. It should be noted that not all ILOs are applicable in all circumstances. Please use the lists as menus to pick and choose from, making sure that the items chosen to form a coherent whole.

Academic attitude and dealing with scientific and scholarly information

This aspect includes knowledge and skills related to the key concepts of the discipline and engineering profile that the program is aimed at. It also includes more general academic skills that a graduate need in order to operate within the engineering profession.

1. can describe the scientific and scholarly procedures and explain their
2. search for (state of the art and properly scientific) information in the library, scientific databases and on the internet using relevant search terms and effective search queries.
3. analyse the information and give arguments for its relevance, its scientific or scholarly cogency
4. process the information by documenting sources used meticulously and fully according to a reference system that is consistently used.
5. describe and apply an appropriate system for documenting sources and the principles underpinning that system.
6. indicate the extent of- or boundaries of their expertise.

Communication

1. present ideas coherently and clearly 1. present ideas coherently such that each idea is shown how it relates to the following idea,
2. underpin each idea with relevant and legitimate evidence.
3. explain and motivate a point of view using compelling evidence as reasons.
4. describe results, methods, and processes with the correct terminology used in the correct way.
5. justify conclusions to others orally, in writing and/or visually.
6. communicate in English in such a way that the interlocutor/assessor can fully understand what is being communicated.
7. listen actively and demonstrate the ability to do so by giving an accurate and concise summary of what has been discussed when challenged to do so.

Oral Presentation

1. demonstrate that the presentation is professionally prepared. [This becomes visible in the care with which all details are taken account of everything is ready and working well before the start of the presentation, and (when applicable) rooms are booked and prepared, the technology is tested and functioning. Media (posters, models, slide-presentation) are all carefully crafted demonstrating an understanding of what effective communication is about.]
2. target the presentation to the intended audience by framing it appropriately to that audience: using concepts, words, images, and explanatory strategies appropriate to that audience.
3. sequence posters and slides according to a clear narrative logic that, if challenged, the student can describe and give reasons for.
4. design posters and slides in such a way that they can be considered as effective vehicles of relevant information leaving out non-relevant information. If challenged the student can describe and argue the relevance of all information on the poster/ slide.
5. give a clear introduction to aim of the presentation and the way it is structured and why the presentation is structured the way it is.
6. speak clearly using the correct technical vocabulary in the correct context and correct way.
7. conclude finished topics and introduce new topics systematically and describing how the one is linked to the other.
8. maintain the interest of the targeted audience without frivolous and trivial means but by attending to the matter in hand.
9. lead the subsequent discussion, demonstrating that the student can listen actively to points made by the committee or the public by answering them sensibly demonstrating their grasp of the topic.

Argumentation and demonstrating understanding

(see also the glossary on 'understanding')

1. describe, define, and demonstrate the application of the concept taught during the performance of research or design.
2. describe a point of view giving reasons underpinning it.
3. analysing a concept or point of view by differentiating it into its constituent parts and showing how the parts relate to each other and describe how each part performs its specific role in that whole.
4. critique or evaluate a point of view by showing how it is of value to some purpose

Writing an article, essay, or report

1. describe what the purpose and most effective form for of the various elements of an article/ essay or report such as:

- **Title/Subtitle**: A phrase that grabs the attention, describes the contents accurately and makes people want to read further.
- **Abstract**: a short paragraph outlining all the parts of the paper and the main conclusion; the abstract should be written last of all, after the conclusion and the introduction.
- **Key words**: words or phrases that can be used by search engines to find relevant content.
- **Problem statement**: a short clear statement of an issue or challenge that sums up what you want to change with the help of your research.
- **Research question**: a question focused on a single issue as to what it is you want to find out about. A research question should be answerable and should be framed by a theoretical position that is made explicit.
- **Thesis**: a theoretical position you want to defend, attack, or otherwise evaluate.
- **Hypothesis**: a reasonable expectation based on factual information that can be tested.
- **Introduction**: contains a problem statement, the topic, its value, or importance, how you plan to proceed, assertion of a thesis giving the main argument.
- **Methodology**: to identify and explain the method applied in your research arguing why it is an appropriate method.
- **Results tables and figures**: these require clarity of presentation, openness, and transparency.
- **Discussion**: to help the reader explore and discover the meaning of the research done or the case argued through interaction between various people or sources.
- **Conclusion**: to bring together the main points of the article and place them in a future perspective sketching answers to questions such as what needs to be further researched, what needs to be done, etc.

- **Layman's Summary**: a summary that can be read by intelligent non-experts in the field.
- **Literature Review**: to collect relevant research summarized coherently and presented as the state-of-the-art knowledge in the field.
- **Research proposal**: an attempt to explain the significance of the project to a person or organisation that might want to support the project in some way.

2. select, apply and organize the report/essay in such a way that all the required elements are in place and so structured that the target audience can, with little effort, make sense of each element and place it within the context of the project as a whole.
3. describe the structure of the report and demonstrate how it follows a path that is logical from a frame of reference or purpose that is made explicit.
4. construct the separate chapters, paragraphs, and sentences so that each follow a narrative logic that can be made explicit.
5. describe how each chapter, paragraph, and sentence are related to the previous and following chapters, paragraphs, and sentences.
6. argue a case thoroughly by giving well-grounded and legitimate reasons/evidence for every decision/claim made.
7. describe and/or demonstrate the proper composition and structure of a sentence (subject verb predicate/object) using the correct tense and punctuation.
8. use the correct technical vocabulary in the correct way.

Visualising, Drawing & Modelling

1. describe the purpose and elements of various kinds of visualisations, drawings or prototypes/models, giving reasons for which technique is best at displaying what kind of information.
2. describe the uses of each scale of a drawing for the purpose it is used.
3. describe and demonstrate what level of technical detail is appropriate to the scale used.
4. communicate accurately and honestly about the design.
5. use the correct codes for materials and elements in a technical drawing.
6. choose, argue, and demonstrate the most effective line thicknesses for the representation of the various elements to be built/produced in a technical drawing.
7. choose, argue, and demonstrate the most effective use of colour and shading.
8. choose, argue, and demonstrate the ability to make effective renders and the most effective viewpoints to show the strengths (and where necessary) weaknesses of the project.
9. make models with care and accurately, give reasons for why the models was made the way it is.
10. give reasons for how the model/prototype gives different information to the drawings.

Calculating

1. present formulas and calculations clearly present formulas and calculations clearly and efficiently.
2. give the steps of the calculation.
3. make explicit the link between the claim made and the calculation underpinning it.

Collaborating

1. participate actively in discussions demonstrating that the student comes to meetings well prepared, actively participates in discussions, has read the required literature and is able to use it to make a point or give well-grounded reasons for a certain point of view held.
2. work with others towards a common goal for a set period.
3. distribute tasks among team members in such a way that individual competences are effectively used and/or developed.
4. give constructive feedback (that is feedback that plays the ball rather than the person and allows the receiver of that feedback to improve performance).
5. be open to feedback and use it to improve performance.
6. take responsibility for their own tasks and doing them as agreed.
7. take responsibility in a project or task-related conflict between peers to find a working relationship and describe what was done and how it helped.
8. make agreements with peers and tutors regarding planning and deliverables.
9. ensuring a socially safe and inclusive environment by using appropriate language and behaviour.

Planning & Organizing

1. organize the student's own activities or activities within a group, so that results are achieved within a predetermined time with the available resources.
2. describe the principles of efficient and effective planning and organizing used (such as the method of agile scrum, Gant charts, task prioritization, etc.).
3. deal with any obstacle or crisis affecting the project by taking the initiative on time evaluate helpful strategies or to seek help

Adaptability

Being durably employable requires students to be able to actively prepare for, as well as adapt to, changing (professional) environments and circumstances. This includes personal initiative in study and career planning, as well as being able to study and work in different environments and as such is a prerequisite for life-long learning.

Demonstrate openness to the comments and criticisms of others by responding to them in a

sensible way, demonstrating an understanding of the issues involved.

Deal with shifting conditions and changing requirements by showing agility with reference to factors that can be adapted without detracting from the final goal and being clear about things that cannot.

Self-directed Learning

1. Identify and describe personal learning needs.
2. Formulate personal learning goals.
3. Identify, choose, and argue appropriate learning activities and strategies.
4. Evaluate learning outcomes and describe that evaluation.

Dealing with Uncertainty

anticipate changes and take, describe, and argue decisions while dealing with uncertainty, ambiguity, and risk.

Pro-activity

Identify, list, and describe opportunities and take initiative.

Innovative Thinking

approach problems from different perspectives, which the student can list and describe and can generate develop and make explicit novel ideas that fit a specific context.

Systems Thinking

Demonstrate an awareness through description/application that problems or solutions are part of a greater system and can identify and indicate the interrelations between individual contributions and their boundaries.

Creativity & Innovation

1. define creativity and innovation as activities and describe successful examples of creativity and innovation according to criteria made explicit.
2. differentiate between wicked problems, tame problems, and puzzles.
3. describe the Copernican mind-set.
4. explore possibilities within a given situation within a given set of parameters.
5. imagine and make explicit through description different possible situations and scenarios and speculate up the possible outcomes with reference to a given purpose or given set of conditions.

Self- and Social Awareness

To be durably employable, students need awareness of their personal learning purpose and ambitions, strengths, weaknesses, values, and beliefs, including the ability to reflect on these. Reflecting on one's own learning process and development is essential to gain insight and learn to give and receive (critical) feedback in a constructive way. This aspect also includes the ability to build and be a constructive part of relevant networks and teams, including international ones, and an awareness of societal and ethical issues in relation to engineering problems.

1. critically and constructively examine their own thoughts and actions, describing their deliberations, evaluate them, process feedback from others, and use the experiences to guide and argue future thoughts and actions.
2. demonstrate awareness through description of how their values, norms, beliefs, ambitions, and expertise (competences, strengths, and weaknesses) shape the type of engineer they can become and of career paths matching their ambitions.
3. demonstrate awareness through description of their environment and consider the challenges/problems of society, making these explicit and describe how their actions may impact society.
4. demonstrate awareness through description of their own as well as team members' perspectives and can redirect their own actions based on interactions with others.
5. take and motivate decisions after having considered and made explicit different ethical perspectives (including user, society, enterprise, and environment).

Reflecting

1. demonstrate the ability to formulate goals that guide their own thinking and actions.
2. demonstrate the ability to critically look at the what, how and why of their thoughts and actions.
3. formulate learning or development points based on hindsight that contribute to a (long-term) goal (e.g. development of professional identity)
4. can formulate and implement alternatives based on hindsight.
5. be open to the criticism and advice of others regarding individual ideas or decisions.

Thematic Learning Areas Learning Outcomes (ILO's)

Herewith a catalogue of Learning outcomes ILO's levels I and II relating to Thematic Learning Areas (TLA).

To avoid endless repetition all the following points assume the following phrase as their point of departure "***At the end of this course the student is able to….***"

(Entrepreneurship and) Sustainability

1. Define and describe the SDG framework
2. Define and describe the Planetary Boundaries framework
3. Define and describe the Environmental Impact framework
4. Describe the impacts and the implications of the challenges regarding New Buildings vs Old
5. Describe the impacts and the implications of the challenges regarding Life Cycle Impacts
6. List and describe the steps for strategies and methods such as Life Cycle Assessment
7. List and describe the steps for strategies and methods such as BREEAM / LEED
8. Describe and discuss the pros and cons of design targets such as Carbon neutrality

Artificial Intelligence

1. Define and describe the notion and purpose of AI
2. List and describe the main subdomains of AI (symbolic and numerical)
3. Describe the state-of-the-art AI methods and techniques relative to data type and purpose in the context of the built environment
4. Describe the societal significance and implications of AI and the responsibilities of an AI expert
5. Describe the implications of applying AI systems in Architecture, Engineering, Construction and Operation (AECO)
6. Evaluate the advantages, disadvantages, challenges, and implication of human – AI interaction
7. Describe the benefits, limitations, and trade-offs of AI technologies and systems
8. Perform basic tasks using relevant AI techniques

Energy Transition

1. Define and describe Energy Production framework
2. Define and describe Storage and Distribution frameworks
3. Define and describe Demand Matching and Demand Reduction framework
4. Describe the impacts and the implications of the challenges regarding Buildings
5. Describe the impacts and the implications of the challenges regarding the Electricity Grid
6. Describe the impacts and the implications of the challenges regarding the District Heating Networks
7. List and describe the steps for strategies and methods regarding BENG
8. List and describe the steps for strategies and methods regarding Energy Performance
9. Describe and discuss the pros and cons of design targets such as Energy neutrality
10. Describe and discuss the pros and cons of design targets such as Self-sufficiency

Materials and processes

1. framework
2. Define and describe the Biobased materials framework
3. Define and describe the Industry 4.0 framework
4. List and describe the steps for strategies and methods regarding Life Cycle Analysis
5. List and describe the steps for strategies and methods regarding MPG
6. List and describe the steps for strategies and methods regarding Circularity Assessment
7. Describe and discuss the pros and cons of design targets Carbon Storage

Inclusivity

1. Define and describe the:
    a. Inclusion framework
    b. Equity framework
    c. Diversity framework
2. Describe the impacts and the implications of the challenges regarding:
    a. Polarization
    b. Exclusion & segregation
    c. Othering
    d. Intersectionality
3. List and describe the steps for strategies and methods such as
    a. Participatory design
    b. Design for inclusion
4. Describe and discuss the pros and cons of:
    a. design targets such as Social Dustainability
    b. Gesign targets such as an Inclusive and plural society
    c. Design targets such as an open society.

What a mark should mean

Marks represent a judgment, and a judgment for it to be understood, needs to be made explicit. In order to encourage a greater convergence within the university as a whole and in helping with the form,ulaition of subject specific rubrics the following proposal is a suggestion as to what a mark should mean. The judgment is given in the paragraph title the mark follows in brackets and then the description of what the judgment should mean follows.

- **Exceptional** (10)
  The project, taken as a whole, is of such a level of outstanding excellence and cogency that it has the expected potential to change the public debate about the discipline lastingly. This criterion does do not even manifest itself in this way in most experienced, academically trained and highly successful academics and professionals. The awarding of such a mark should be discussed before awarding it, with the program director and the examination committee.
- **Excellent** (9)
  The graduation project, taken as a whole, is exemplary, such that the judge would ideally want the design to be actualised/produced, the research published and implemented. This level of excellence is worthy of being exhibited and/or published, perhaps with some minor modifications.
- **Very Good** (8)
  The project, taken as a whole, is very good on all fronts, clearly presenting the case made for the design/research and weighing each consideration well and explicitly. This level of excellence conforms precisely and well to all end terms and ILO's of the course. Students receiving this mark should feel very proud of their achievement.
- **Good** (7)
  The project, taken as a whole, is adequate and more or less answers all the ILO's. Perhaps the full consequences of a claim have not been fully overseen, and perhaps some of the evidence is shaky or missing, but these can be compensated by parts that warrant a higher mark or do nothing to diminish the validity of the research work or design proposition. Students receiving this mark should feel very satisfied about their achievement.
- **Sufficient (pass)** (6)
  The project, taken as a whole, is just about satisfactory although the consequences of a claim are lacking and the evidence for some claims is lacking or faulty; the design/ research more or less works, but shows faults either by being muddled, showing inconsistencies and/or missing elements. However, various parts compensate others. Students receiving this mark should feel unsatisfied but not crestfallen about their achievement.
- **Almost sufficient** (fail) (5)
  The project, taken as a whole, is below par. The research is slovenly, claims are not properly thought through or underpinned with proper evidence and are not inferentially robust. A design does not, despite the serious effort made, quite work as a proposition whilst the argumentation fails on many fronts. Students receiving this mark should feel dissatisfied about their achievement and would want to redo the course.
- **Insufficient** (4)
  This mark should be awarded to those who have not understood the implications (consequences or intentions) behind their own design decisions or the implications (conclusions) of their research findings and who cannot argue them satisfactorily, but who might well benefit from doing the project again.
- **Critically low** (1-3)
  These marks should only be awarded to those who have attitudinal problems, who have not taken the project seriously and who present incomplete projects without reason. Students receiving these marks should reconsider the career direction they have taken.

The Peer Advantage

ENHANCING LEARNING THROUGH STUDENT FEEDBACK

In today's educational landscape, where collaboration, critical thinking, and communication are fundamental aspirations of higher education, peer feedback stands out as a powerful method for enriching student learning. Essentially, peer feedback involves a dialogue among students about standards of quality in relation to their own performance. When seamlessly integrated into a course, it enables students to assess the quality of their work and refine their learning strategies for improvement.

What do we know about the benefits of peer feedback?

Engaging with the work of their peers enhances students' performance on learning outcomes, fosters essential metacognitive skills, and boosts personal and professional competencies, such as teamwork and communication. Researchers have shown that well-designed peer feedback activities foster student learning in a number of ways:

- Students develop a greater awareness of high-quality work and use it to improve their own work.
- Students develop advanced self-assessment skills that help them address problems in their work.
- Students enhance their teamwork skills that often transfer into the workplace.
- Students broaden their perspectives on task content and on the learning process as they review and discuss peers' work.
- Students actively engage in the feedback process, often finding it easier to enter into dialogue with peers than to question feedback from teachers.

Who benefits from peer feedback?

An interesting research finding is that providing peer feedback is often more impactful than receiving it. When students review and comment on their peers' work, they engage in complex cognitive activities that enable them to transfer knowledge to enhance their own performance. These activities include assuming the perspective of a critical reader (which enhances the ability to monitor and refine one's work), engaging in problem-solving by analyzing peers' work and proposing solutions, and articulating comments on strengths and weaknesses, which deepens students' understanding of the topic.

For teachers, explaining these learning gains to students may heighten motivation to participate in the peer feedback process.

How to make peer feedback work for everyone?

Research on the advantages of peer feedback for reviewers doesn't discount the learning potential for students receiving feedback. Instead, it underscores the significance of fostering active engagement during the entire feedback process. Teachers can facilitate this engagement by modeling specific, actionable, and respectful feedback strategies to help students understand both how to define the core feedback message and how to deal with the emotional aspects of feedback. Other effective peer feedback strategies include prompting students to create improvement plans based on the feedback they receive, facilitating feedback dialogues for clarifying misunderstandings and discussing improvement, and encouraging students to articulate feedback requests for a more focused feedback on their work.

The transition towards peer feedback suggests a broader shift in educational practice where student involvement in feedback is intrinsic to the curriculum rather than an isolated occurrence. By embracing this approach, educators can equip students with essential skills in critical thinking, communication, and self-assessment, and in this way support a more enriching educational journey.

CURRICULUM OVERVIEW

The first year

Great! You are at the start of the bachelor program Architecture, Urbanism and Building Sciences (AUBS). Welcome to the Department of the Built Environment, and we wish you a great deal of success with your studies!
During the first year, students take common ground courses to develop their basic knowledge and lay the foundation for their development as an engineer. They soon discover that this program requires them to be on the ball; the pace of the program is fast and it includes many deadlines. This will be experienced as a significant change from high school and requires commitment, discipline and good planning skills. All courses and projects in grade 1 are of the Introductory level.

Timeslots		Mo	Tue	We	Thu	Fr
08.45-10.30	1+2	A	C	B	E	D
10.45-12.30	3+4	A	C	B	E	D
13.30-15.15	5+6	B	E	D	A	C
15.30-17.15	7+8	B	E	D	A	C
17.30-19.15	9+10	E	D	A	B	C

Legenda tables

Unit or course type	Color Code
AUDE	
BPS	
SED	
USRE	
Core course	
Common ground	
Elective course	
Project	

Q1	Q2	Q3	Q4
Calculus variant A Coursecode: 2WAB0 Timeslot: AB	Architecture & The City Coursecode: 7A1B10 Timeslot: A	Systems in the City: stakeholders, tools, and spaces Coursecode: 7U1B10 Timeslot: E	Impact of Technology : Engineering Ethics Coursecode: 0LVX10 Timeslot: AE
Healthy & sustainable living environments Coursecode: 7UB1B10 Timeslot: D	Statics of structure Coursecode: 7S1B10 Timeslot: D	Circularity and Energy Performance in the Built Environment Coursecode: 7B1B10 Timeslot: D	Structure & Architecture Coursecode: 7AS1B10 Timeslot: D
Project S Project line Coursecode: 7P1B10 Timeslot: BC	Project M Project line Coursecode: 7P2B10 Timeslot: BC	Project L Project line Coursecode: 7P3B10 Timeslot: BC	Project preparing for Track (choice 1 of 4 projects) Timeslot: BC

Project line Y1 - Q4			
Project Urban living - analysis & (re)development of urban areas Coursecode: 7P4UB10 Timeslot: BC	Project Architectural design Coursecode: 7P4AB10 Timeslot: BC	Project Research and experiments to improve building design Coursecode: 7P4BB10 Timeslot: BC	Project Structural Design Coursecode: 7P4SB10 Timeslot: BC

COURSE DESCRIPTIONS

FIRST YEAR

This section briefly outlines the content of the first-year courses and projects. These courses constitute the knowledge-base of students beginning year two of the Bachelor College curriculum. The following tables briefly show which P&PD and Thematic Learning Areas topics are addressed in which course or project.

Theme	Theme
Academic attitude and dealing with scientific and scholarly information	Planning & Organizing
Communication	Adaptability
Oral Presentation	Self and social awareness & Reflecting
Writing	(Entrepreneurship and) Sustainability
Argumentation and demonstrating understanding	Energy Transition
Drawing & modelling	Materials and processes
Calculating	Inclusivity
Collaborating	Artificial Intelligence

Themes	Academic attitude	Communication	Oral Presentation	Writing	Argumentation	Drawing & modelling	Calculating	Collaborating	Planning & Organizing	Adaptability	Self & social awareness	Sustainability	Energy Transition	Materials and processes	Inclusivity	Artificial Intelligence
Q1																
Project S	●		●		●	●		●	●			●				
Healthy and Sustainable Living Environments					●			●				●	●		●	
Calculus - general TU/e course							●									
Q2																
Project M		●	●		●	●		●	●	●					●	
Architecture and the City		●	●	●		●		●	●						●	
Statics of structures		●					●	●								
Q3																
Project L	●	●	●	●	●	●		●	●							
Systems in the City: stakeholders, tools, and spaces										●			●		●	
Circularity and Energy Performance in the Built Environment												●	●	●		
Q4																
ITEC Ethics BE - general TU/e course																
Structure & Architecture				●		●										
Project Urban living - analysis & (re)development of urban areas		●		●	●											
Project Architectural design						●										
Project Research and experiments to improve building design	●												●			
Project Structural Design				●		●		●	●					●		

Project S

Course code	Course level	Offered by	Year	Quartile
7P1B10	Introductory	BPS & AUDE	1	1

SHORT DESCRIPTION

In this project you design a house, for a specific set of inhabitants, starting from the spatial and physical demands of the desired rooms. In a few consecutive steps - looking at separate spaces, then how you put these spaces together, and looking at comfort, energy consumption and generation, and sustainable building materials – you develop your house into a coherent building design. In the end, all individual house designs of the group are put together to form a small street.

CONCEPTS

- Research (verb)
- Design (verb)
- Space
- Scale
- Spatial configuration
- Building mass
- Spatial context
- Sightlines
- Daylight
- Artificial light
- Building material
- Ventilation
- Heating
- Energy consumption

LEARNING OBJECTIVES

Students who have successfully completed the S-project will be able to:

Approach a given problem methodically by formulating a problem definition, the setting of gals, and considering and weighing alternative solutions, describing their reasons for making decisions taken

- Reflect on the student's design process
- Reflect on the student's learning process
- Plan a limited research and design project well in time
- Actively participate in a group with the goal of learning
- Integrate building physics and architectural themes in design
- Determine architectural spaces, their configuration, and the spatial relation of this configuration to the surrounding spatial context, for a given simple design brief and a given location and describe their reasons for making design decisions
- Determine requirements regarding comfort, energy consumption, and the sustainable use of building materials, on a basic level, and to translate these requirements into the design of a simple structure and describe their reasons for making their design decisionsresent a research/ design clearly and concisely in written, visual (drawings, model) or oral form.

The research & design projects in the first three quartiles offer a first introduction to the full scope of the professional and academic field of the built environment. This will be done by research and design assignments focused on indoor comfort and design (project S), on structural design (project M), on urban planning, design, and real estate (project L) and the development of professional skills, drawing and media skills.Project S is the first design project in the first year. A design assignment for a house – an object easily related to from direct experience - will be approached from a spatial perspective, on the scale of the architecture of the house itself and its relation to its direct spatial context, and from the perspective of building physics, comfort, energy consumption, and the sustainable use of materials. Research will comprise spatial analysis, and basic building-physical measurements.

Healthy and Sustainable Living Environments

Course code	Course level	Offered by	Year	Quartile
7UB1B10	Introductory	USRE BPS	1	1

SHORT DESCRIPTION

Students will learn the basics regarding making built environments, ranging from spaces to buildings to cities, more healthy, sustainable, and user-friendly. The course deals with building physics, urban physics, urban development, and transportation. Basic theories and guidelines will be explained in order to understand the consequences of design decisions and to assess the quality of designs for buildings and urban environments.

CONCEPTS

- Sustainable development goals
- Quality of life,
- Healthy living environment
- Outdoor/indoor air quality
- Comfort
- Moisture
- Ventilation
- Insolation
- Heat transfer
- Heat/thermal capacity materials
- Acoustics
- Light
- Energy consumption
- Renewable and circular materials
- Urban heat island
- Climate resilient cities
- City concepts
- Compact cities, green cities
- Land use
- Urbanization
- Housing demand
- Preferences
- Willingness to pay
- Spatial interaction

LEARNING OBJECTIVES

At the end of this course the student is able to:

- Describe the global challenges and health threats and their relationship to the built environment on different scale levels: indoor space, Buildings, Neighborhood and City.
- Describe the relevant concepts and its indicators related to the user's needs for a healthy and comfortable indoor /outdoor space (physical, physiology, psychology/behavior).
- Evaluate general design solutions with regard to their consequences for a healthy built environment (based on provided concepts/methods) by discussing advantages and disadvantages of each. Evaluate (design) solutions for defined cases, considering the value propositions and requirements for the user and society (design guidelines/rules of thumb etc.) by discussing advantages and disadvantages of each.
- Approach a design challenge from an integral and multi-disciplinary perspective by being able to describe and discuss each design decision from various interlocking points of view.

Personal &Professional Development (P&PD) learning objectives:

- Describe and discuss the pros and cons of design targets.
- List and describe strategies and methods to arrive at a healthy and sustainable built environment.
- Describe the impacts and the implications of the challenges with regard to, e.g., energy transition in the built environment and livable cities.
- Define and describe the SDG framework.
- Define and describe the Equity framework.
- To list and describe what other ideas are compatible or incompatible with the claim made.
- Describe what outcomes may be expected on the basis of that claim? What guarantees can you give on the basis of that idea?

Calculus - general TU/e course

Course code	Course level	Offered by	Year	Quartile
2WAB0	Introductory	M&CS	1	1

SHORT DESCRIPTION

Technical science uses mathematics as a language to describe phenomena and to solve problems. With trigonometry one can describe waves. In many problems an optimal setting of parameters should be found. This can be done with mathematical techniques such as differentiation. Integral calculus is needed for the calculation of a center of gravity. Many models use differential equations. In this course you will learn these and other basic techniques with applications.

CONCEPTS

- Elementary algebra and high schoolmathematics including algebraiskills (such as solving inequalities), Cartesian coordinates, and functions;
- Limits:
- Differentiation:
- Transcendental functions:
- Integration:
- First-Order Differential Equations:
- Vectors in the Plane and in Space:

LEARNING OBJECTIVES

Recapitulation of elementary algebra and high school mathematics with emphasis on algebraic skills (such solving inequalities), Cartesian coordinates, and functions. In particular, algebraic manipulation of trigonometric, exponential and logarithmic functions.

- Understanding the conceptual definition of limits; able to compute various types of limits; able to determine whether a function is continuous, or can be extended to a continuous function
- Understanding the notion of differentiable functions; able to interpret derivatives in terms of angent line; able to compute derivatives using the product, quotient, and chain rules; able to use implicit differentiation
- Understanding the concept of linear and (higher order) approximations of functions and apply them
- Able to determine linear approximations of functions; able to apply l'H&ocircpital's rule for computing limits
- Understanding the conceptual definition of one-to-one functions and inverses and apply them
- Able to determine inverse functions of one-to-one (injective) functions; in particular, knowing the main properties of the natural logarithm (as inverse of the exponential function) and of the inverse trigonometric functions
- Understanding the concepts of integration and apply them
- Able to compute definite and improper integrals using various tech integration by substitution and integration by parts
- Understanding sums and Sigma notation, Riemann sums
- Understanding the concepts of differential equations and apply them
- Able to solve simple first-order differential equations (separable differential equations)
- Understanding the concepts of vectors and representations of lines and planes and apply them
- Able to find equations and parametric (vector) equations for lines in the plane and in space, for planes in space
- Able to interpret and compute with dot products and cross products
- Able to determine lengths of vectors, distances and angles between vectors.

Project M

Course code	Course level	Offered by	Year	Quartile
7P2B10	Introductory	SED & AUDE	1	2

SHORT DESCRIPTION

In this project you design an observation tower, looking both into the structure – how do you ensure stability, which forces do you have to reckon with, how these forces are distributed, which materials can you use, what size do columns and beams have to be – and into the architectural design – what do you want this tower to look like, which spaces do you need, how do you move up the tower, how do you design the framing of the views – you finally bring structural and architectural considerations into a coherent unity.

CONCEPTS

- Research (verb)
- Design (verb)
- Dimensioning
- Force distribution
- Stability
- Rigidity
- Spatial design
- Architectural expression
- Tectonics
- Vertical distribution

LEARNING OBJECTIVES

Recapitulation of elementary algebra and high school mathematics with emphasis on algebraic
Students who have successfully completed the M-project will be able to:

Process:

- Approach a given problem methodically by formulating a problem definition, setting goals, considering and weighing alternative solutions describing their reasons for making decisions taken.
- Reflect on the student's design process.
- Reflect on the student's learning process.
- Plan a limited research and design project well in time.
- Actively participate in a group with the goal of learning.

Product:

- Translate an own set of requirements made explicit into a medium size building.
- Integrate structure and architectural themes in design and describe how that was done.
- Design a feasible medium size structure using the basic structural design concepts: structural elements, material properties, grids, stability, force distribution and dimensioning (rules of thumb or references).
- Design a medium size building using the basic architectural concepts: function/use, spatial design, tectonics, and architectural expression and describe their choices and the reasons underpinning them.
- Present a research/design clearly and concisely in written, visual (drawings, model) or oral form.

Architecture and the City

Course code	Course level	Offered by	Year	Quartile
7A1B10	Introductory	AUDE	1	2

SHORT DESCRIPTION

In order to understand the basic concepts (like plan, street, grid, hierarchy, scenography, program and many many more) of architecture and urbanism, we have to look back in history. In the lectures we explain and discuss the concepts and the ideas behind them. In the seminars we analyze iconic 20th century houses to discover how the basic concepts can be applied.

CONCEPTS

LEARNING OBJECTIVES

Lectures:

- Students will be able to define and describe the basic concepts Students will be able to explain and demonstrate the basic concepts by relating them to specific examples.

Seminars:

- Students will be able to recognize how these concepts can be applied.
- Students will be able to describe and apply the primary tools of architectural analysis.
- Students will be able to relate the terms form, space and order to the analyzed houses by drawing and modelling architectural elements, and describing how they spatially connect and describing their ordering principle(s).
- Personal &Professional Development (P&PD) learning objectives:
- Collaborating: Be open to feedback and use it to improve their study performance.
- Oral presentation: Give a clear introduction to the structured presentation describing how and why the presentation is structured the way it is.
- Communication: Present ideas coherently and clearly underpinned with evidence.
- Drawing & modelling: Make accurate models with care and give reasons for why the model was made the way it is.
- Drawing & modelling: Choose, argue and demonstrate the most effective line thicknesses for the representation of the various elements in an architectural drawing.

The first-year course ‘Architecture and the City’ consists of lectures and seminars. The lectures are a thematic introduction to the basic concepts of architecture and urbanism and their historical backgrounds. During the lectures, a simple question will be the central focus point: What concepts are useful to help us understand our built environment and talk about it sensibly? This question will be answered by a series of 24 lectures in which the different concepts and the ideas behind it will pass.

Statics of structures

Course code	Course level	Offered by	Year	Quartile
7S1B10	Introductory	SED	1	2

SHORT DESCRIPTION

No building without a structure! Structures are indispensable in transferring the loads to the foundation, and strongly determine the appearance of buildings. The course provides the basic principles of equilibrium of structures and treats the relationships between the shape of a structure and the corresponding force distribution.

CONCEPTS

- Mathematical description of mechanics concept of vectors
- 2D statically determinate structures
- Trusses
- Cross-section properties
- Schematize structures
- Stability of structures
- Structural optimalisation

LEARNING OBJECTIVES

The objective is that the student acquired the specific basic knowledge and skills after the end of the course the student :

- Knows the meaning of and the difference between applied mechanics and structural design within the field of the Built Environment.
- Can schematize a structure (with regard to geometry, supports and loads);
- Is able to determine the magnitude of the reaction forces on and the magnitude of the forces (normal forces, shear forces, bending, and torsion) in statically determinate structures, using the equilibrium conditions. The structures can adopt a complex geometry and can be 2-dimensional as well as 3-dimensional.
- Knows the function and the meaning of N-V- and M-diagrams and can derive these for statically determinate structures.
- Knows the function and responsibility of the structural designer. Knows the meaning of a structural design.
- Knows and recognizes the appearance of the most important structural elements and their mechanical behavior: tension rods, beams, compression arches, columns, floor systems, supports and joints, walls, stabilizing elements, foundations.
- Can give a global indication where tension/compression/bending will occur in existing structures.
- Can analyze the stability of structures and knows the basic stability principles, in particular for one-story building structures.
- Knows the relationship between loads, normal stresses and deformations, and the material behavior (sigma-epsilon diagram), and the strength and stiffness properties.
- Can explain the basic relation between structural safety, serviceability, and loads of buildings. Knows the principles of the elaboration in standards and the principles of load cases, safety- and material factors and load combinations.
- Can give a global indication of the load transmission of tension, compression and/or bending via the foundations onto the supporting earth.
- Can qualitatively sketch a simple deformation, shear force diagram and moment diagram based on the expected mechanical behavior and deformations of a simple 2D structure
- Can design a simple (one-story) structure using global dimensioning formulas and is able to provide stability in the structure.
- Knows the three basic principles to further optimize a simple structure (Material savings by optimizing the element’s cross-section; Adjusting the shape of the structure to minimize moments; Adjust the element’s shape to follow the moment diagram).

Project L

Course code	Course level	Offered by	Year	Quartile
7P3B10	Introductory	USRE & AUDE	1	3

SHORT DESCRIPTION

In this project you do an academic research into a city neighborhood or district, and on the basis of the outcomes you a basic urban design. The research comprises problem definition, literature study, data analysis, SWOT-analysis and the use of evaluation tools. The conclusion of the research is then used to generate several design proposals, to select the most suitable proposal, which then is elaborated into a final urban design proposal.

CONCEPTS

- Research (verb)
- Design (verb)
- Data analysis
- Literature study
- Hypothesis
- SWOT-analysis
- Real estate
- Mass study
- Street sections
- Block typology

LEARNING OBJECTIVES

Students who have successfully completed the L-project will be able to:

- Adopt an academic mindset and show this in being critical, reflective and involved;
- Understand the necessity of integral design related to Systemic Urban Planning, Design and Real Estate (SUPDRE) themes in particular;
- Understand the basics of a scientific design approach: problem definition/specify objectives – analysis – concept development – concept design – conclusion/reflection;
- Design a feasible urban plan using the basic SUPDRE concepts: analysis (spatial and social analysis), urban planning, urban design, real estate, stakeholders, levels of scale (building – district – city - region), use of tools (e.g. MCA);
- Communicate their process as well as a product in written, visual (drawn, model) or oral form with colleagues and peers from within or outside of the field of the profession clearly and convincingly.
- More specifically students will learn to:
- Formulate a problem definition for a designated area and specify the objective;
- Perform an analysis regarding the spatial (urban context: transport and mobility / facilities and functions / public space and greenery etc.) as well as social (stakeholders / socio demography/ user needs-preferences etc.) characteristics of a district, resulting in an assessment (strengths and weaknesses) of the area;
- Implement the output of the analysis into several concept development proposals;
- Demonstrate the understanding of an evaluation tool (e.g. MCA) to select the best proposal;
- Develop the selected concept into a basic preliminary urban design;
- Critically reflect on the process as well as the product;
- Present the process as well as the product (in writing, orally, visually).

Systems in the City: stakeholders, tools, and spaces

Course code	Course level	Offered by	Year	Quartile
7U1B10	Introductory	USRE	1	3

SHORT DESCRIPTION

Cities are complex environments in which many functions need to be accommodated and a huge variety of opinions exist on how best to do that. Therefore, citizens and many stakeholder groups together shape the Built Environment; and vice versa: the Built Environment has the power to shape citizens and society. By being able to distinguish and understand the different systems at play in our urban environments – such as real estate markets, mobility, health and digital systems – future urban planning and design professionals can make sure value is created for city dwellers.

CONCEPTS

Citizens and society shape the Built Environment:

- Urban systems
- Human-environment interaction
- Drivers of urban change (social, technological, environmental, economic, and political factors – STEEP)
- Transformation processes Stakeholders
- Multi-disciplinary collaboration

Building scale:

- Property markets
- Real estate development

Urban & neighborhood scale:

- Urban planning and design paradigms
- Urban planning and design tools
- Placemaking
- Public spaces
- Healthy living

Mobility:

- Mobility markets
- Urban Infrastructure Accessibility
- Sustainable mobility

Technology in BE:

- Digitalization
- Smart buildings
- Emerging technologies
- Spatial decision support systems
- Digital Twins

LEARNING OBJECTIVES

- list and define factors that make cities into complex systems; describe the nature of that complexity and describe the way that various disciplines collaborate to research, plan, design, and manage this system in order for them to be sustainable and supportive of human wellbeing.
- Define basic factors influencing human-environment interaction and discuss the implications; for example, the relationships between activity patterns, land use, place attachment, accessibility, transportation, well-being, etc.), and describe how to plan for that interaction.
- Describe how the property market and its submarkets work, including the consumer-, investor-, and construction markets in real estate.
- Describe the role of digitalization and emerging technologies on the built environment (on the levels of citizens, buildings and cities) and discuss the impact and implications for that role.

Personal &Professional Development (P&PD) learning objectives:

Inclusivity:

- List and describe the steps for strategies and methods such as participatory design.
- Describe and discuss the pros and cons of design targets such as an open society and social sustainability.
- Describe the impacts and the implications of the challenges regarding intersectionality.

Adaptability:

- Demonstrate an awareness through description that problems or solutions are part of a greater system and can identify and indicate the interrelations between individual contributions and their boundaries.
- Approach problems from different perspectives, which the student can list and describe; and can generate, develop, and make explicit novel ideas that fit a specific context.

Circularity and Energy
Performance in the Built Environment

Course code	Course level	Offered by	Year	Quartile
7B1B10	Introductory	BPS	1	3

SHORT DESCRIPTION

This course aims at introducing the general concepts of circularity and sustainability, by focusing on the different materials used in buildings as well as their energy performance. Students will learn basic concepts with reference to the material sciences, from cement chemistry to insulating materials, but also more advanced concepts related to the circular economy and sustainable (e.g. bio-based) materials. In addition, they will learn about the implications of design decisions (building envelope and building services) on building physics, with a focus on heat gain and loss and the resulting energy demand. They will learn how to link this to, for example, health & comfort, as well as to the aspect of durability as related to moisture transport. Overall, the aspects of materials, energy, and systems are correlated and analyzed with specific examples in order to showcase the possible options to build future-proof environments for the user.

CONCEPTS

- Conduction
- Transmission losses
- Infiltration
- Facade, roof and floor types
- condensation
- thermal bridges
- water vapor barriers and openings
- Solar heat gains
- SHGF
- Solar shading
- Windows properties
- Heat balance
- Ventilation and cooling systems
- Raw materials
- Material circularity
- Type of materials and products
- Material's properties (physical, mechanical, chemical...)
- Material's characterization
- Material's application (civil engineering and architecture)

LEARNING OBJECTIVES

At the end of the course, the student will be able to:

- Describe the relationship between the characteristics of different building materials to building physics processes in the building envelope, esthetics, sustainability, and applicability in the built environment.
- Analyze and design external building constructions based on the principles of building physics and the characteristics of building materials.
- Describe and explain basic building services concepts (heating, cooling, ventilation).Describe the characteristics of different common building materials in terms of durability, physics, mechanics, esthetics
- Describe the production process of common building materials
- Describe and discuss the relations between characteristics of different building materials and the sustainability goals
- List the heat losses and gains that occur in a building
- Calculate basic transmission and ventilation heat losses
- Recognize and explain different systems/designs for facades, roofs, floors
- Describe the process of surface- and internal condensation
- Describe and discuss the different concepts for building ventilation
- List the most common heating systems and describe their characteristics
- Analyze and describe building constructions based on the principles of building physics and the characteristics of building materials

Design a building envelop based on principles of building physics and the characteristics of building materials.
comfort, as well as to the aspect of durability as related to moisture transport. Overall, the aspects of materials, energy, and systems are correlated and analyzed with specific examples in order to showcase the possible options to build future-proof environments for the user.

ITEC Ethics BE - general TU/e course

Course code	Course level	Offered by	Year	Quartile
0LVX10	Introductory	IE & IS	1	4

SHORT DESCRIPTION

Ethics of Technology and Engineering introduces students to normative skills that help engineers, designers, and researchers to make decisions concerning ethical questions. These skills are needed e.g., to understand the complex societal context of sustainable mobility and energy systems, to deal with and to identify privacy aspects of all kinds of smart systems, or to help solve controversial health and risk issues. Students acquire insights into basic ethical concepts (such as values, risks and responsibilities) and analyse the role these concepts play in the context of the development and design of technologies.

CONCEPTS

LEARNING OBJECTIVES

The overall aim of Ethics of Technology and Engineering is to introduce students to the role of ethics in engineering and innovation in their first year. It covers the following learning outcomes:

Basic ability to reflect on ethical aspects of engineering in a societal context;

Basic ability to conduct a normative analysis of engineering with the help of ethical concepts (such as values, risks and (shared) responsibility);

Basic ability to conceive and evaluate solutions to engineering challenges with the help of classical ethical theories (such as utilitarianism, deontology and virtue-ethics).

Structure & Architecture

Course code	Course level	Offered by	Year	Quartile
7AS1B10	Introductory	AUDE & SED	1	4

SHORT DESCRIPTION

In this course we address the relation between Structural Design and Architectural Design and how these disciplines can mutually benefit from each other. How can the architectural expression of a building come from the structure and the way that is articulated? How can thinking about the structure be the start of your design instead of something you try to ‘fix’ in the end? The course consists of a series of lectures organized around three different construction materials: timber, concrete, and steel. Students participating in the course will design a small building three times, using the different materials discussed in the lectures. The design should architecturally express the possibilities that specific material has to offer. Students will learn about tectonics (the expression of material and structure), how to use rules of thumb and structural schemes in a design process, how to find beauty in structure and how to elaborate the design to a basic detail.

CONCEPTS

- Structural Design as a basis for architectural expression and vice-versa (Tectonics/ Solid and Filigree construction/ Architectural Expression);
- Importance of design-thinking with materials and making as a starting point (material basis of design);
- Design with Rules of Thumb / Structural Scheme / Stability / Spans (primary/ secondary)
- Introduction to the role of details in execution and expression of a building (connection between structural elements AND between structure and facade/skin) [focus on challenging/inspiring students];
- Making / Sequence; timber/steel/concrete/ hybrid.

LEARNING OBJECTIVES

The aim of the course is to learn how Structural and Architectural Design can strengthen each other and to discover the unique expression of three main structural materials: timber, concrete, and steel.

- Design (3x) a simple structure, architecturally expressing 3 different materials / construction methods;
- Specify, align and synergize architectural and structural qualities;
- Draw a technically and architecturally motivated detail of the skin meeting the structure.

Content

- In this course we address the relation between Structural Design and Architectural Design and how these disciplines can mutually benefit from each other.
- How can the architectural expression of a building come from the structure and the way that it is articulated? How can thinking about the structure be the start of your design instead of something you try to fix in the end?
- The course consists of a series of lectures organized around three different construction materials: timber, concrete and steel. Students participating in the course will design a small building three times, using the different materials discussed in the lectures. The design should architecturally express the possibilities that specific material has to offer. This sequence of two-week design exercises results in a series of three physical scale models.
- Students will learn about tectonics (expression), how to use rules of thumb and structural schemes in a design process, how to find beauty in structure and how to elaborate the design to a basic detail.
- Video interviews with leading architects and structural designers, form a central part of the study material for the course.
- Structure & Architecture is linked to Building Technology in the second year and other courses in the “Architecture & Engineering” line, such as Architecture & Technology (third year), Architectural Engineering (Master) and the Building Technology Master Certificate.

Project Urban living - analysis & (re)development of urban areas

Course code	Course level	Offered by	Year	Quartile
7P4UB10	Introductory	USRE	1	4

SHORT DESCRIPTION

Students will investigate the determinants of healthy living environments, design a tool to assess neighborhoods based on these determinants and propose strategies to make neighborhoods healthier. In order to provide students with sufficient skills, they will learn how to collect, store, manage, analyze, and represent spatial data by means of Geographic information systems (GIS), a basic tool for real estate (re) developers, urban designers, and urban and transportation planners.

CONCEPTS

- Healthy urban environments
- Healthy behavior
- Measurement tool
- Conceptual model
- Geographical Information System
- Spatial data models
- Spatial objects
- Spatial data
- Spatial data management
- Spatial data analysis
- Thematic maps

LEARNING OBJECTIVES

At the end of this course the student can:

- Perform a scientific literature study regarding the determinants of healthy residential living environments, resulting in a conceptual model.
- Develop a measurement instrument to assess the quality of a residential neighborhood regarding healthy urban living, including a description of the relevant assessment criteria, and how to measure these criteria with the help of a geographical information system (GIS), or other means in cases where GIS is not suitable for the assessment.
- Collect relevant spatial information and analyze the data (amongst others with GIS), draw conclusions, and define spatial strategies to improve the neighborhood in order to stimulate healthy behavior.
- Describe concepts related to geographical information systems.
- Describe and demonstrate methods/procedures related to geographical information systems.
- Describe and demonstrate data-management procedures.
- Describe and demonstrate the procedures to access main spatial and non-spatial databases.

Personal &Professional Development (P&PD) learning objectives:

- Describe what claim is made and what evidence there is for making such a claim.
- List and describe what other claims must already be in place for the student to make that claim.
- Describe results, methods, and processes with the correct terminology used in the correct way.
- Communicate in English in such a way that the interlocutor can fully understand what is being communicated.
- Describe how each chapter, sections, and sentence are related to the previous and following chapters, sections, and sentences.

Project Architectural design

Course code	Course level	Offered by	Year	Quartile
7P4AB10	Introductory	AUDE	1	4

SHORT DESCRIPTION

In this project the student will design a medium size building with a relatively complex program on a given location, with a given list of requirements. Based on a concise analysis of the program and the urban context, students will, in consecutive steps, look into the architectural themes of space (urban/exterior and architectural/interior), configuration and sequences of spaces, light, sightlines, façade design, structure, material and detail. The aim is to provide insight in basic aspects of urban and architectural design.

CONCEPTS

- Architectural and urban design (verb)

LEARNING OBJECTIVES

Students who have successfully completed the project will be able to:

Product (design skills):

- Translate a simple list of requirements into a spatial design for a building;
- Fit this design to its context in a well-reasoned way (urban scale level and façade design);
- Determine shape and size of spaces in a well-reasoned way;
- Determine configuration and sequences of spaces (how spaces are grouped together) in a well-reasoned way;
- Determine the way daylight enters a building in a well-reasoned way;
- Express architectural ideas in the choice of material and in the structure;
- Express architectural ideas in an architectural detail (scale level of the architectural detail).

Presentation (presentation skills):

- Graphically present a building design in precise, complete and corresponding drawings: site plan, floorplans, elevations and sections, on appropriate scales;
- Orally explain a building design and the reasoning behind it in a clear and concise way.

Process (attitude):

- Critically reflect on your design work and that of others (academic learning mindset);
- Reflect on the design process and process feedback;
- Solve design problems independently and methodically: know how to define and analyse a problem, how to generate multiple solutions, and how to choose one of these as solution for your design.

Project Research and experiments to improve building design

Course code	Course level	Offered by	Year	Quartile
7P4BB10	Introductory	BPS	1	4

SHORT DESCRIPTION

This project focuses on the improvement of living environments by focusing on tangible experiments in order to understand the phenomena that affect comfort or health, discussed in the previous courses in year 1. Within the “BPS lab”, students will be able to perform different measurements using state-of-the-art methods such as characterization of materials properties (e.g. electron microscope), thermal analysis, lighting, acoustics and more.

CONCEPTS

- BPS design
- Material characterization
- Light measurements
- Heat and moisture measurements

LEARNING OBJECTIVES

In this project, the students will perform multiple experiments in relation to the BPS field, in order to better understand the concepts learned during the first year. Different BPS aspects will be studied, such as materials properties, lighting, acoustic, heat transfer, etc., by means of real experiments to illustrate theories studied previously during different courses.

Project Structural Design

Course code	Course level	Offered by	Year	Quartile
7P4SB10	Introductory	SED	1	4

SHORT DESCRIPTION

In this project, you will design a building with a large span, for example, a swimming pool or elephant accommodation. The focus of the project is on structural design. How do you ensure stability, which forces do you have to reckon with, how are these forces distributed, which materials can you use, and what size do the structural elements have to be? Within the Project Structural Design, it is possible to focus on structural design only or link the project with architecture or building physics.

CONCEPTS

The research & design projects in the fourth quartile offer a first introduction to a specific professional and academic field of the built environment. This will be done in the Q4 project Structural Design by a spatial design assignment focusing on the structure and general professional and media skills. In this project, a building with a large span is designed, for example, a swimming pool or elephant accommodation. The focus of the project is on structure design. The project aims to give more insight into the basic concepts of structural design, which should be applied to a spacial design. For example, how do you ensure stability, which forces do you reckon with, how are these forces distributed, which materials can you use, and what size do the structural elements have to be? Within the project, it is possible to focus on structural design only or link the project with architecture or building physics

LEARNING OBJECTIVES

Students who have successfully completed the project Structural Design will be able to:

Process (40%):

- Approach a given problem methodically by formulating a problem definition, setting goals, considering, and weighing alternative solutions describing their reasons for making decisions taken.
- Reflect on the student's design process.
- Reflect on the student's learning process.
- Plan a limited research and design project well in time.
- Actively participate in a group with the goal of learning.

Product (60%):

- Translate an own set of requirements made explicit into a building with a large span.
- Design a feasible structure using the basic SED concepts: structural elements, material properties, grids, stability, load and force distribution, and dimensioning (rules of thumb, references, Technosoft).
- Calculate structural dimensions using stresses or integrate basic architectural/ building physics concepts into a structural design.
- Present a research/design clearly and concisely in written, visual (drawings, model) and oral form.

Second and third year intro

Multidisciplinary Project: B, A & U come together

Year three starts with the Multidisciplinary project. You will work on a large project, in a team consisting of students from multiple disciplines. During two quartiles, you will explore the role of an architect, urban designer, structural engineer, building physicist, project developer, etc. It is the perfect chance to find out which (sub)discipline best fits your interests and ambitions.

Bachelor end project and follow-up Master programs

The Bachelor End Project is the last preparation before you can start a master program. During one semester (two quartiles) you will test yourself within one specific discipline. This gives you the opportunity to show your knowledge and skills, and find out which master specialization fits your interests and ambitions best.

During the third year you can orientate on our master programs of the TU/e Graduate School: Architecture, Building and Planning (ABP) and Construction Management and Engineering (CME). The master program ABP has six tracks you can choose from:

- Architectural Urban Design and Engineering (AUDE),
- Building Physics and Services (BPS),
- Structural Engineering and Design (SED),
- Urban Systems & Real Estate (USRE),
- Sustainable Urban Mobility Transitions (SUMT),
- Smart Mobility Data Science and Analytics (SMDSA)

In November we will organize the Master Track Week, where we will give detailed information about the master programs.
Already want to know more? Please check the Education Guide (educationguide.tue.nl/programs/graduate-school/masters-programs/).

Good to know

- You can only start the Multidisciplinary Projects if you have completed the three or four mandatory B, A or U projects from the program of year 2.
- The Multidisciplinary Project consists of two parts which are graded separately.
- You can only start the Bachelor End Project (BEP) after completing the multi project. In case of delay you can also follow the BEP in Q1-Q2.

In order to complete the bachelor, you must take a number of steps. You can find the checklist and more information on the educationguide (educationguide.tue.nl/programs/bachelor-college/majors/architecture-urbanism-and-building-sciences/curriculum/completion-of-bachelor-preparation-for-master).

International experience

You can already prepare for an international experience in your master. Consult the handouts for download on the Education Guide (educationguide.tue.nl/programs/graduate-school/masters-programs/architecture-building-and-planning/international-experience/).

Contact the International Office (exchange.be@tue.nl) for additional information. Registration deadlines are:

Sep 1 for semester B, 2024-2025

Mar 1 for semester A, 2025-2026

Curriculum schedule

* Quantitative methods and Statistics will be given in the different tracks in year 2 or year 3
SURE and BPS track - Year 2, Q1
AUDE and SED track - Year 3, Q1

Legenda tables

Unit or course type	Color Code
Core course	
Common ground	
Elective course	
Project	

Year 2

In the second year, students specialize in the one of four disciplines and complement these with their chosen electives. In Q4 of this year they work together with students from other faculties on a Challenge Based Learning project. Here they learn to work in teams and how to communicate effectively with people on their team from different disciplines to achieve optimal results.
Core courses are displayed bold, the green cels are electives. BC Challenge Based Learning Project is considered an elective : within this course there is elective space.
The bottom row of the year always shows the projects.

Q1	Q2	Q3	Q4
Elective	Elective	Elective	**BC Challenge Based Learning Project**
Quantitative Research Methods and Statistics *	**Core Course**	**Core Course**	**Qualitative Research and Design-oriented Methods**
Project	Project	Project	Project

Year 3

The third year is mainly about the multidiscipolinary project and the graduation project. It is an opportunity for students to demonstrate their ability to conduct independent research into their chosen discipline in a methodical manner and to show that they can develop and present a design using their newly acquired insights.

Q1	Q2	Q3	Q4
Elective	Elective	Elective	Elective
Core Course	**Core Course**	**ITEC Advanced (society)**	Elective
Multidisciplinary Project		Bachelor graduation project	

CORE COURSES BUILT ENVIRONMENT

Core courses are courses that are required when committing to one of the tracks within the Bachelor of Architecture, Urbanism and Building Sciences (AUBS) program.

There are 4 tracks to choose from provided from the 4 units:

- Architectural Urban Design and Engineering (AUDE)
- Building Physics and Services (BPS)
- Urban Systems and Real Estate (USRE)
- Structural Engineering and Design (SED)

Q1	Q2	Q3	Q4
Quantitative Research Methods and Statistics Coursecode: 7U0B20 Level: Advanced Timeslot: C	Histories of Architecture and Urbanism Coursecode: 7A1B20 Level: Advanced Timeslot: C	ITEC – Engineering for Society Coursecode: 0LVX20 Level: Deepening Timeslot: B	Qualitative Research and Design-oriented Methods Coursecode: 7ES2B20 Level: Advanced Timeslot: C
	Architecture and Technology Coursecode: 7A0B30 Level: Deepening Timeslot: C	Type & Form Coursecode: 7A2B20 Level: Deepening Timeslot: D	Multidisciplinary CBL Coursecode: 4CBLW00 Level: Advanced Timeslot: C+D
Dimensioning of structures Coursecode: 7S0B20 Level: Deepening Timeslot: B	Foundations of Data Analytics Coursecode: ? Timeslot: ?	Timber Structures and Applied Mechanics Coursecode: 7S2B20 Level: Advanced Timeslot: D	
Urban planning Coursecode: 7U0B30 Level: Deepening Timeslot: A	Urban Projects & Finance Coursecode: 7U1B30 Level: Advanced Timeslot: A		

CORE & ELECTIVE COURSES BUILT ENVIRONMENT

A student can choose any core course from another track as an elective as long as this fits in their program. Students are not allowed to choose courses that would overlap in their timetable. Some core courses offered by one track are recommended to students from other tracks. Here is a list.

Q1	Q2	Q3	Q4
Parts & Details Coursecode: 7A0B20 Level: Introductory Timeslot: C	Building Services Coursecode: 7B1B30 Level: Advanced Timeslot: A	Urbanism & Architecture in context Coursecode: 7EA4B20 Level: Deepening Timeslot: C	
Building Performance Coursecode: 7B0B30 Level: Deepening Timeslot: A	Matrices and Differential Equations Coursecode: ??? Level: Advanced Timeslot: B	Urban Physics Coursecode: 7B0B20 Level: Introductory Timeslot: C	
	Concrete and Masonry Structures Coursecode: 7S0B30 Level: Advanced Timeslot: B		
	Steel Structures and Applied Mechanics Coursecode: 7S1B20 Level: Advanced Timeslot: A		

Legenda tables

Timeslots		Mo	Tue	We	Thu	Fr
08.45-10.30	1+2	A	C	B	E	D
10.45-12.30	3+4	A	C	B	E	D
13.30-15.15	5+6	B	E	D	A	C
15.30-17.15	7+8	B	E	D	A	C
17.30-19.15	9+10	E	D	A	B	C

Unit or course type	Color Code
AUDE	
BPS	
SED	
USRE	
Common ground	

ELECTIVES BUILT ENVIRONMENT

Each track offers electives that can be chose by diggers, binders and climbers.

Q1	Q2	Q3	Q4
Design for a Sustainable Future Coursecode: 7EA1B20 Level: Introductory Timeslot: A	Geometry & Form Coursecode: 7EA3B20 Level: Introductory Timeslot: A	Making Meaning: Drawing & Modelmaking Coursecode: 7EA0B20 Level: Deepening Timeslot: C	City models Coursecode: 7EA10B20 Level: Advanced Timeslot: C
Making Meaning: Drawing & Modelmaking Coursecode: 7EA0B20 Level: Deepening Timeslot: A	Landscape & Public Space Coursecode: 7EA2B20 Level: Deepening Timeslot: B	Tectonics & Materiality Coursecode: 7EA5B20 Level: Advanced Timeslot: B	Geometry & Form Coursecode: 7EA3B20 Level: Introductory Timeslot: A
Tectonics & Materiality Coursecode: 7EA5B20 Level: Advanced Timeslot: A	Spatial Imagination Coursecode: 7EA6B20 Level: Introductory Timeslot: A	Theories of Architecture and Urbanism Coursecode: 7EA7B20 Level: Advanced Timeslot: A	Urban Case Study Coursecode: 7EA9B20 Level: Introductory Timeslot: C
		Walkscapes Coursecode: 7EA8B20 Level: Advanced Timeslot: A	Walkscapes Coursecode: 7EA8B20 Level: Advanced Timeslot: A
Building acoustics Coursecode: 7EB0B20 Level: Introductory Timeslot: A	Physics of light and lighting design Coursecode: 7EB1B20 Level: Deepening Timeslot: A	Materialization of facades and roofs Coursecode: 7EA7B20 Level: Advanced Timeslot: C	Room acoustics Coursecode: 7EB3B20 Level: Introductory Timeslot: B
Sustainable Design of Structures Coursecode: 7ES0B20 Level: Advanced Timeslot: B		Healthful environments: light, wellbeing and the biological clock Coursecode: 0HVL10 Level: Introductory Timeslot: D	Experimental research of structures and materials Coursecode: 7ES2B20 Level: Advanced Timeslot: C
Mobility and Forecasting Coursecode: 7EU3B20 Level: Deepening Timeslot: B	Design project Smart Mobility Coursecode: 7EU4B20 Level:Deepening Timeslot: B	Digital Structures Coursecode: 7ES1B20 Level: Introductory Timeslot: C	Geographic modeling of the built environment Coursecode: 7EU6B30 Level: Introductory Timeslot: B
Housing, RE & urban Economics Coursecode: 7EU0B20 Level: Deepening Timeslot: A	Digital Built Environment Coursecode: 7EU1B20 Level: Introductory Timeslot: B	Transportation Engineering Coursecode: 7EU2B20 Level: Introductory Timeslot: B	Project Smart Cities Coursecode: 7EU5B20 Level: Advanced Timeslot: A

PROJECTS BUILT ENVIRONMENT

Each track offers projects that can be chose by diggers, binders and climbers.

Track	Q1	Q2	Q3	Q4
Year 2				
AUDE	AUDE project 1: Making & Structure Coursecode: 7PA1B20 Level: Deepening Timeslot: D+E	AUDE Project 2: Program & Typology Coursecode: 7PA2B20 Level: Deepening Timeslot: D+E	AUDE Project 3: Housing & Public Space Coursecode: 7PA3B20 Level: Deepening Timeslot: D+E	AUDE Project 4: Urban Design & Landscape Coursecode: 7PA4B20 Level: Deepening Timeslot: D+E
BPS	Building inspection for future-proofing Coursecode: 7PB1B20 Level: Deepening Timeslot: D+E	Sustainable Retrofit Coursecode: 7PB2B20 Level: Deepening Timeslot: D+E	Regenerative Building Design Coursecode: 7PB3B20 Level: Deepening Timeslot: D+E	Climate-responsive Building Design Coursecode: 7PB4B20 Level: Deepening Timeslot: D+E
SED	Project 1 Structural Engineering & Design Coursecode: 7PS1B20 Level: Deepening Timeslot: D+E	Project 2 Structural Engineering & Construction Technology Coursecode: 7PS2B20 Level: Deepening Timeslot: D+E	Project 3 Structural Engineering & Building Technology Coursecode: 77PS3B20 Level: Deepening Timeslot: D+E	Project 4 Research project in Structural design Coursecode: 7PS4B20 Level: Deepening Timeslot: D+E
	Combined project Structural & Architectural Design 1 Coursecode: 7PS1B21 Level: Deepening Timeslot: D+E	Combined project Structural & Architectural Design 2 Coursecode: 7PS2B21 Level: Deepening Timeslot: D+E	Combined project Structural & Architectural Design 3 Coursecode: 7PS3B21 Level: Deepening Timeslot: D+E	Combined project Structural & Architectural Design 4 Coursecode: 7PS4B21 Level: Deepening Timeslot: D+E
USRE	Project Making sustainable real estate feasible Coursecode: 7PU1B20 Level: Deepening Timeslot: D+E	Project Green, healthy and social neighborhoods Coursecode: 7PU2B20 Level: Deepening Timeslot: D+E	Project Urban mobility Coursecode: 7PU3B20 Level: Deepening Timeslot: D+E	Project Urban restructuring Coursecode: 7PU4B20 Level: Deepening Timeslot: D+E
Year 3	Multidisciplinary Project Coursecode: 7P1B30 Level: Advanced Timeslot: D+E		Bachelor End Project (10 ECTS) Coursecodes: 7A2B30 7B2B30 7S2B30 7U2B30 Level: Advanced Timeslot: D+E	

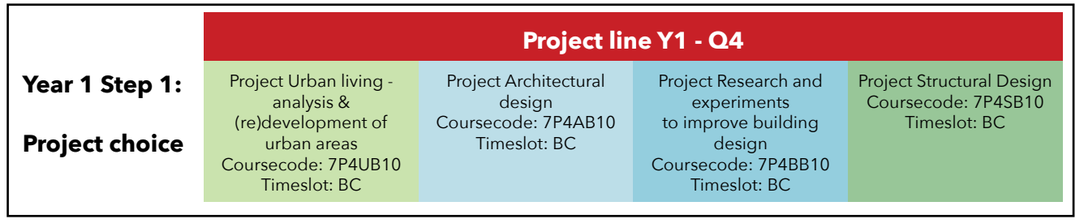
Practical assignment "Bouwkundewinkel" (7ES3B20)

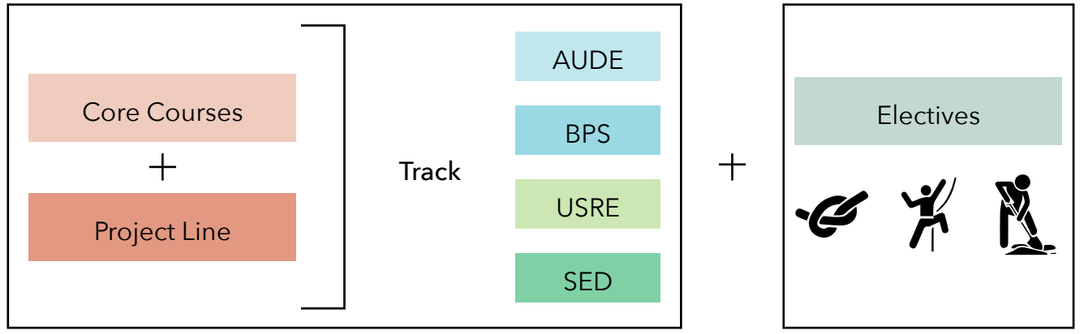
The "Bouwkundewinkel" gives students the opportunity to put their knowledge into practice. Practical problems and design questions with a real client are translated into research assignments.

TRACK & PROFILE CHOICE

Second and third year

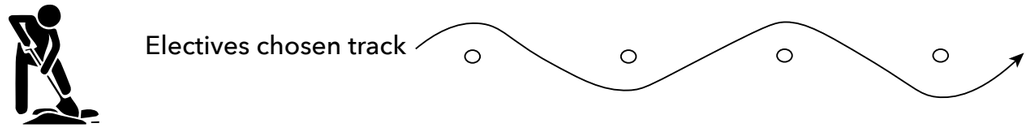
The profiles are only indicative. We encourage self-directed learning and students are completely free to choose their own track and electives as long as these fit in their timetable and do not overlap with other (core) courses of their chosen track. To inspire and help students get started, we have defined three profiles. An initial choice was already made in academic year 1 where a project was chosen in the last quartile as an orientation to a track choice.





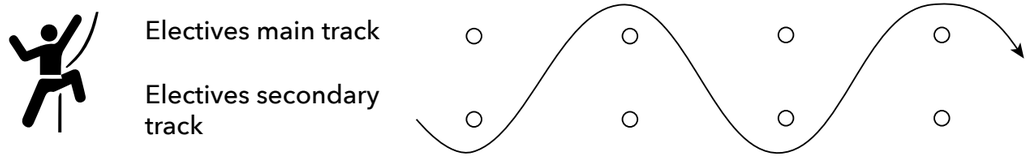
year 2 Step 2: Track choice **Step 3: Profile choice**

Digger - Electives from selected track



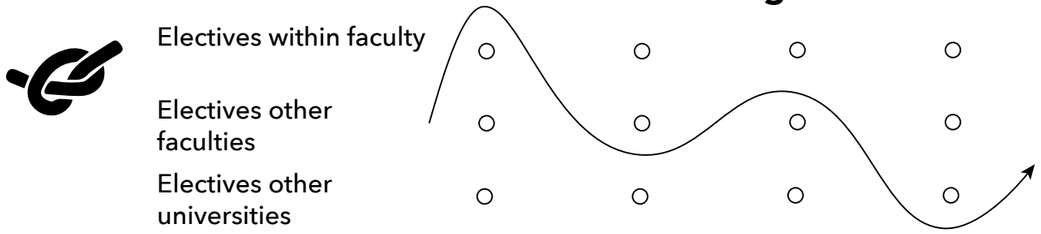
Students who want to dive deep into their discipline, each unit will design a track with electives to accommodate this profile.

Climber - Electives from other track(s)



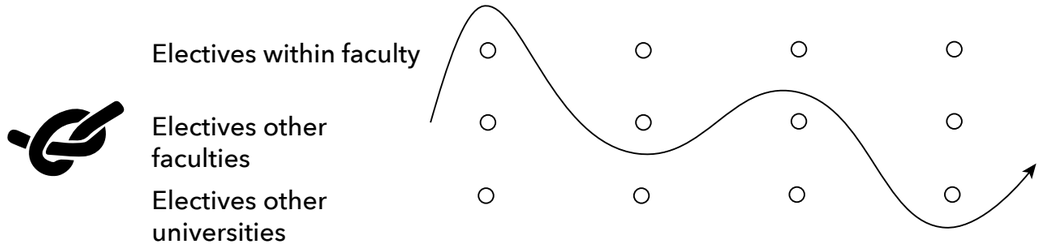
Students who want to create a unique profile for themselves by combining their chose track with courses from another track. These students might be preparing themselves to do a double major.

Binder - Electives based on a Thematic Learning Area



Students who want to combine their disciplinary knowledge with a commitment to one or more of the societal challenges we face (Built Environment Thematic Learning Areas - Production 2.0, Energy transition, Sustainability or Inclusivity). Students can choose electives on, for example, sustainability, from other courses at the faculty, at other faculties or other universities worldwide.

Binder



A binder chooses the electives based on a selected Thematic Learning Area (TLA). Themes concern various aspects, such as sustainability, artificial intelligence, inclusiveness, circularity, energy transition. The electives can therefore be courses not only within the faculty and university, but also from all other universities in the world.

These are the Thematic Learning Areas:

- Energy transition
- Artificial Intelligence
- Materials (Production 2.0)
- Sustainablility
- Enterpreneurship
- Inclusivity

Example

		Quarter 1	Quarter 2
Year 2	BC line	TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY	WAGENINGEN UNIVERSITY & RESEARCH
	Subject Line	**Quantitative Research Methods and Statistics**	**Core Course main track**
	Research & project Line	Project main track	Project main track
Year 3	BC line	EuroTeQ Engineering University	EuroTeQ Engineering University
	Subject Line	**Core Course chosen track**	**Core Course chosen track**
	Research & project Line	Multidisciplinary Project main track	

		Quarter 3	Quarter 4
Year 2	BC line	WAGENINGEN UNIVERSITY & RESEARCH	Multidisciplinary CBL
	Subject Line	**Core Course main track**	**Qualitative Research and Design-oriented Methods**
	Research & project Line	Project main track	Project main track
Year 3	BC line	TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY	TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY
	Subject Line	**ITEC Advanced (society)**	
	Research & project Line	Bachelor End Project main track	

Education at partner institutions

TU/e joins forces with other universities and partners at home and abroad. In your elective courses you can choose to follow courses at these partner institutions or to participate in (international) challenges and competitions.

EUROTEQ

The EuroTeQ Engineering University aims at shaping the future of European Engineering. The offerings are developed to enable intercultural and multilingual competences and an entrepreneurial mindset. The focus is to instill in students and lifelong learners the ability to think and act responsibly and be ready to lead a competitive and sustainable Europe into the future. Students can choose from a set of (virtual) courses available at our European partner universities via the EuroTeQ Course Catalogue. They can also choose to participate in the EuroTeQ Collider, the challenge-based learning initiative where the winning team can compete against peers from partner universities at the EuroTeQathon.

On the website: https://euroteq.eduxchange.eu/ students can find all the information they are looking for. You can filter by field of interest, starting date, university, etc.

Unlike at TU/e, we now work with Run's instead of semester A and B. Still, the periods run fairly parallel, only the registration is much earlier.

STRATEGIC ALLIANCE TU/E, WUR, UU AND UMC UTRECHT

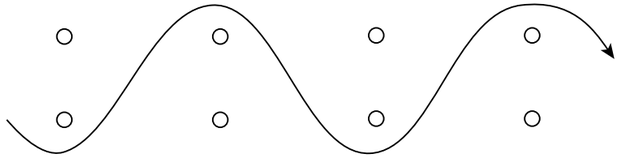
Enrol in courses and minors offered by higher education institutions in the netherlands.

- Alliance TU/e, WUR, UU, UMC Utrecht (EWUU)

Climber

Electives main track

Electives secondary track



A program of a climber is organized by combining courses from two different tracks of Built Environment department of TU/e.

Example

		Quarter 1	Quarter 2
Year 2	BC line	Elective main track - AUDE	Elective secondary track - SED
	Subject Line	**Quantitative Research Methods and Statistics**	**Core Course main track**
	Research & project Line	Project main track	Project main track
Year 3	BC line	Elective secondary track - SED	Elective main track - AUDE
	Subject Line	**Core Course main track**	**Core Course main track**
	Research & project Line	Multidisciplinary Project main track	

		Quarter 3	Quarter 4
Year 2	BC line	Elective secondary track - SED	Multidisciplinary CBL
	Subject Line	**Core Course main track**	**Qualitative Research and Design-oriented Methods**
	Research & project Line	Project main track	Project main track
Year 3	BC line	Elective main track - AUDE	Elective secondary track - SED
	Subject Line	**ITEC Advanced (society)**	Elective main track - AUDE
	Research & project Line	Bachelor End Project main track	

Digger

Electives chosen track

The following pages show the 4 digger profiles. Provided by the 4 units:

AUDE - ARCHITECTURAL URBAN DESIGN AND ENGINEERING

A high quality built environment emerges from the careful consideration of issues specific to a situation and this requires a critical and often innovative attitude. The core program for architecture and urbanism is about finding the right fit between social, cultural, political, economic and environmental demands and testing them against the possibilities offered by technology, engineering and design. The building industry needs to come up with innovative answers that can help markets and governments move towards an appropriate model for future development without losing the wealth that we have built up. In the master courses and projects of Architecture and Urban Design and Engineering we stand at the cradle of inventive solutions for concrete spatial issues, based on substantial research, emphasizing the possibilities of the program, the qualities of a context and the rich traditions of the disciplines.

BPS - BUILDING PHYSICS AND SERVICES

The track Building Physics and Services covers a wide range of interdisciplinary research topics connected to building physics and building services. The aim is to acquire new knowledge and integrate and develop design methods that lead to a sustainable, healthy, comfortable and productive indoor and outdoor environment. The focus of attention is on physical aspects and processes such as heat and moisture transfer in building constructions, indoor air quality, lighting, acoustics, heating, ventilation, airconditioning and materials.

USRE - URBAN SYSTEMS AND REAL ESTATE

The track Urban Systems & Real Estate (US&RE) deals with teaching and research in the field of real estate management and (re)development; urban planning, (re)development and management of cities; and developing systems to support designers and decision makers. The track focuses on the functioning of cities including the local housing market, residential neighborhoods, shopping malls, urban green spaces, offices, et cetera, and transportation networks to connect all these components. In order to investigate how people live, work, shop, recreate and move around in cities, tools and models are developed to simulate and predict people's activities and travel in the city. Such tools can be used to assess the likely effects of policy measures which may aim at making cities smarter and healthier, improving the quality of life in cities, reducing energy use and minimizing exposure to noise and air pollution. The focus on smart mobility and energy, jointly with ICT implies the combination of expertise to contribute to the development of smart and sustainable cities. Related professions are - amongst others- real estate manager, real estate developer, urban planner, transportation planner, researcher, spatial policy maker, building information technologist, expert in design and decision support systems, and process expert in large urban projects.

SED - STRUCTURAL ENGINEERING AND DESIGN

The track Structural Engineering and Design is based on five core courses, several specialization electives and some free electives. The core courses focus on knowledge on and application of structural materials as well as on several methods to solve mechanical problems. Structural design related courses as well as projects are part of the specialization electives. The projects can be divided in design projects (large span structures as well as high rise buildings) and in research projects (experimental research as well as numerical research). The courses enable the student to specify and acquire individual knowledge and competences within the field of structural design.

AUDE year 2

AUDE offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from AUDE can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Year 2	BC line	Making Meaning: Drawing & Modelmaking Coursecode: 7EA0B20 Level: Deepening Timeslot: A	Landscape & Public Space Coursecode: 7EA2B20 Level: Deepening Timeslot: B	Urbanism & Architecture in context Coursecode: 7EA4B20 Level: Deepening Timeslot: C	Multidisciplinary CBL Coursecode: 4CBLW00 Level: Advanced Timeslot: C+D
		Design for a Sustainable Future Coursecode: 7EA1B20 Level: Introductory Timeslot: A	Steel Structures and Applied Mechanics Coursecode: 7S1B20 Level: Advanced Timeslot: A	Making Meaning: Drawing & Modelmaking Coursecode: 7EA0B20 Level: Deepening Timeslot: C	
			Geometry & Form Coursecode: 7EA3B20 Level: Introductory Timeslot: A	Tectonics & Materiality Coursecode: 7EA5B20 Level: Advanced Timeslot: B	
	Subject Line	**Parts & Details** **Coursecode: 7A0B20** **Level: Introductory** **Timeslot: C**	**Histories of Architecture and Urbanism** **Coursecode: 7A1B20** **Level: Advanced** **Timeslot: C**	**Type & Form** **Coursecode: 7A2B20** **Level: Deepening** **Timeslot: D**	**Qualitative Research and Design-oriented Methods** **Coursecode: 7ES2B20** **Level: Advanced** **Timeslot: C**
	Research & project Line	AUDE project 1: Making & Structure Coursecode: 7PA1B20 Level: Deepening Timeslot: D+E	AUDE Project 2: Program & Typology Coursecode: 7PA2B20 Level: Deepening Timeslot: D+E	AUDE Project 3: Housing & Public Space Coursecode: 7PA3B20 Level: Deepening Timeslot: D+E	AUDE Project 4: Urban Design & Landscape Coursecode: 7PA4B20 Level: Deepening Timeslot: D+E

AUDE year 3

AUDE offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from AUDE can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Year 3	BC line	Tectonics & Materiality Coursecode: 7EA5B20 Level: Advanced Timeslot: A	Building Services Coursecode: 7B1B30 Level: Advanced Timeslot: A	Materialization of facades and roofs Coursecode: 7EA7B20 Level: Advanced Timeslot: C	Walkscapes Coursecode: 7EA8B20 Level: Advanced Timeslot: A
		Design of Structures and Sustainable Design Coursecode: 7ES0B20 Level: Advanced Timeslot: B	Spatial Imagination Coursecode: 7EA6B20 Level: Introductory Timeslot: A	Theories of Architecture and Urbanism Coursecode: 7EA7B20 Level: Advanced Timeslot: A	Urban Case Study Coursecode: 7EA9B20 Level: Introductory Timeslot: C
		Building acoustics Coursecode: 7EB0B20 Level: Introductory Timeslot: A	Concrete and Masonry Structures Coursecode: 7S0B30 Level: Advanced Timeslot: B	Parametric Design and Digital Manufacturing Coursecode: 7ES1B20 Level: Introductory Timeslot: C	City models Coursecode: 7EA10B20 Level: Advanced Timeslot: C
				Walkscapes Coursecode: 7EA8B20 Level: Advanced Timeslot: A	Geometry & Form Coursecode: 7EA3B20 Level: Introductory Timeslot: A
	Subject Line	**Quantitative Research Methods and Statistics** **Coursecode: 7U0B20** **Level: Advanced** **Timeslot: C**	**Architecture and Technology** **Coursecode: 7A0B30** **Level: Deepening** **Timeslot: C**	**ITEC - Engineering for Society** **Coursecode: 0LVX20** **Level: Deepening** **Timeslot: B**	**All electives available in this timeslot**
	Research & project Line	Multidisciplinary Project Coursecode: 7P1B30 Level: Advanced Timeslot: D+E		Bachelor End Project (10 ECTS) Coursecodes: 7A2B30 Level: Advanced Timeslot: D+E	

BPS year 2

BPS offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from BPS can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Year 2	BC line	Building acoustics Coursecode: 7EB0B20 Level: Introductory Timeslot: A	Physics of light and lighting design Coursecode: 7EB1B20 Level: Deepening Timeslot: A	Healthful environments: light, wellbeing and the biological clock Coursecode: 0HVL10 Level: Introductory Timeslot: D	Multidisciplinary CBL Coursecode: 4CBLW00 Level: Advanced Timeslot: C+D
	Subject Line	**Quantitative Research Methods and Statistics Coursecode: 7U0B20 Level: Advanced Timeslot: C**	**Matrices and Differential Equations Coursecode: ??? Level: Advanced Timeslot: B**	**Urban Physics Coursecode: 7B0B20 Level: Introductory Timeslot: C**	**Multidisciplinary CBL Coursecode: 74CBLW00 Level: Advanced Timeslot: C+D**
	Research & project Line	Building inspection for future-proofing Coursecode: 7PB1B20 Level: Deepening Timeslot: D+E	Sustainable Retrofit Coursecode: 7PB2B20 Level: Deepening Timeslot: D+E	Regenerative Building Design Coursecode: 7PB3B20 Level: Deepening Timeslot: D+E	Design Coursecode: 7PB4B20 Level: Deepening Timeslot: D+E

BPS year 3

BPS offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from BPS can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2
Year 3	BC line	Parts & Details Coursecode: 7A0B20 Level: Introductory Timeslot: C Design of Structures and Sustainable Design Coursecode: 7ES0B20 Level: Advanced Timeslot: B	All electives available in this timeslot
	Subject Line	**Building Performance Coursecode: 7B0B30 Level: Deepening Timeslot: A**	**Building Services Coursecode: 7B1B30 Level: Advanced Timeslot: A**
	Research & project Line	Multidisciplinary Project Coursecode: 7P1B30 Level: Advanced Timeslot: D+E	

		Quarter 3	Quarter 4
Year 3	BC line	Materialization of facades and roofs Coursecode: 7EA7B20 Level: Advanced Timeslot: C	Room acoustics Coursecode: 7EB3B20 Level: Introductory Timeslot: B
	Subject Line	**ITEC - Engineering for Society Coursecode: 0LVX20 Level: Deepening Timeslot: B**	**All electives available in this timeslot**
	Research & project Line	Bachelor End Project (10 ECTS) Coursecodes: 7B2B30 Level: Advanced Timeslot: D+E	

SED year 2

SED offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from SED can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Year 2	BC line	Parts & Details Coursecode: 7A0B20 Level: Introductory Timeslot: C	Matrices and Differential Equations Coursecode: ??? Level: Advanced Timeslot: B	Materialization of facades and roofs Coursecode: 7EA7B20 Level: Advanced Timeslot: C	Multidisciplinary CBL Coursecode: 4CBLW00 Level: Advanced Timeslot: C+D
		Building Performance Coursecode: 7B0B30 Level: Deepening Timeslot: A			
	Subject Line	**Dimensioning of structures Coursecode: 7S0B20 Level: Deepening Timeslot: B**	**Steel Structures and Applied Mechanics Coursecode: 7S1B20 Level: Advanced Timeslot: A**	**Timber Structures and Applied Mechanics Coursecode: 7S2B20 Level: Advanced Timeslot: D**	**Qualitative Research and Design-oriented Methods Coursecode: 7ES2B20 Level: Advanced Timeslot: C**
	Research & project Line	Project 1 Structural Engineering & Design Coursecode: 7PS1B20 Level: Deepening Timeslot: D+E	Project 2 Structural Engineering & Construction Technology Coursecode: 7PS2B20 Level: Deepening Timeslot: D+E	Project 3 Structural Engineering & Building Technology Coursecode: 77PS3B20 Level: Deepening Timeslot: D+E	Project 4 Research project in Structural design Coursecode: 7PS4B20 Level: Deepening Timeslot: D+E
		Combined project Structural & Architectural Design 1 Coursecode: 7PS1B21 Level: Deepening Timeslot: D+E	Combined project Structural & Architectural Design 2 designCoursecode: 7PS2B21 Level: Deepening Timeslot: D+E	Combined project Structural & Architectural Design 2 Coursecode: 7PS3B21 Level: Deepening Timeslot: D+E	Combined project Structural & Architectural Design 3 Coursecode: 7PS4B21 Level: Deepening Timeslot: D+E

SED year 3

SED offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from SED can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2
Year 3	BC line	Sustainable Design of Structures Coursecode: 7ES0B20 Level: Advanced Timeslot: B	Building Services Coursecode: 7B1B30 Level: Advanced Timeslot: A Architecture and Technology Coursecode: 7A0B30 Level: Deepening Timeslot: C
	Subject Line	**Quantitative Research Methods and Statistics Coursecode: 7U0B20 Level: Advanced Timeslot: C**	**Concrete and Masonry Structures Coursecode: 7S0B30 Level: Advanced Timeslot: B**
	Research & project Line	Multidisciplinary Project Coursecode: 7P1B30 Level: Advanced Timeslot: D+E	

		Quarter 3	Quarter 4
Year 3	BC line	Digital Structures Coursecode: 7ES1B20 Level: Introductory Timeslot: C	Experimental research of structures and materials Coursecode: 7ES2B20 Level: Advanced Timeslot: C
	Subject Line	**ITEC – Engineering for Society Coursecode: 0LVX20 Level: Deepening Timeslot: B**	**All electives available in this timeslot**
	Research & project Line	Bachelor End Project (10 ECTS) Coursecodes: 7S2B30 Level: Advanced Timeslot: D+E	

USRE year 2

USRE offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from USRE can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2
Year 2	BC line	Housing, RE & urban Economics Coursecode: 7EU0B20 Level: Deepening Timeslot: A	Landscape & Public Space Coursecode: 7EA2B20 Level: Deepening Timeslot: B Digital Built Environment Coursecode: 7EU1B20 Level: Introductory Timeslot: B
	Subject Line	**Quantitative Research Methods and Statistics Coursecode: 7U0B20 Level: Advanced Timeslot: C**	**Foundations of Data Analytics Coursecode: ? Timeslot: ?**
	Research & project Line	Project Making sustainable real estate feasible Coursecode: 7PU1B20 Level: Deepening Timeslot: D+E	Project Green, healthy and social neighborhoods Coursecode: 7PU2B20 Level: Deepening Timeslot: D+E

		Quarter 3	Quarter 4
Year 2	BC line	Transportation Engineering Coursecode: 7EU2B20 Level: Introductory Timeslot: B	Multidisciplinary CBL Coursecode:4CBLW00 Level: Advanced Timeslot: C+D
	Subject Line	**Urbanism & Architecture in context Coursecode: 7EA4B20 Level: Deepening Timeslot: C**	**Qualitative Research and Design-oriented Methods Coursecode: 7ES2B20 Level: Advanced Timeslot: C**
	Research & project Line	Project Urban mobility Coursecode: 7PU3B20 Level: Deepening Timeslot: D+E	Project Urban restructuring Coursecode: 7PU4B20 Level: Deepening Timeslot: D+E

USRE year 3

USRE offers these courses and projects. Core courses are displayed bold, the green cels are electives. The bottom row of the year always shows the projects. Diggers from USRE can choose these electives. Climbers from other tracks can choose from the core courses as well as the electives. Binders from other tracks can choose from the core courses and the electives if they are labelled with one or more of the Thematic Learning Areas (Energy, Sustainability, Inclusion) are suitable for the binders.

		Quarter 1	Quarter 2
Year 3	BC line	Mobility and Forecasting Coursecode: 7EU3B20 Level: Deepening Timeslot: B	Design project Smart Mobility Coursecode: 7EU4B20 Level:Deepening Timeslot: B
	Subject Line	**Urban planning Coursecode: 7U0B30 Level: Deepening Timeslot: A**	**Urban Projects & Finance Coursecode: 7U1B30 Level: Advanced Timeslot: A**
	Research & project Line	Multidisciplinary Project Coursecode: 7P1B30 Level: Advanced Timeslot: D+E	

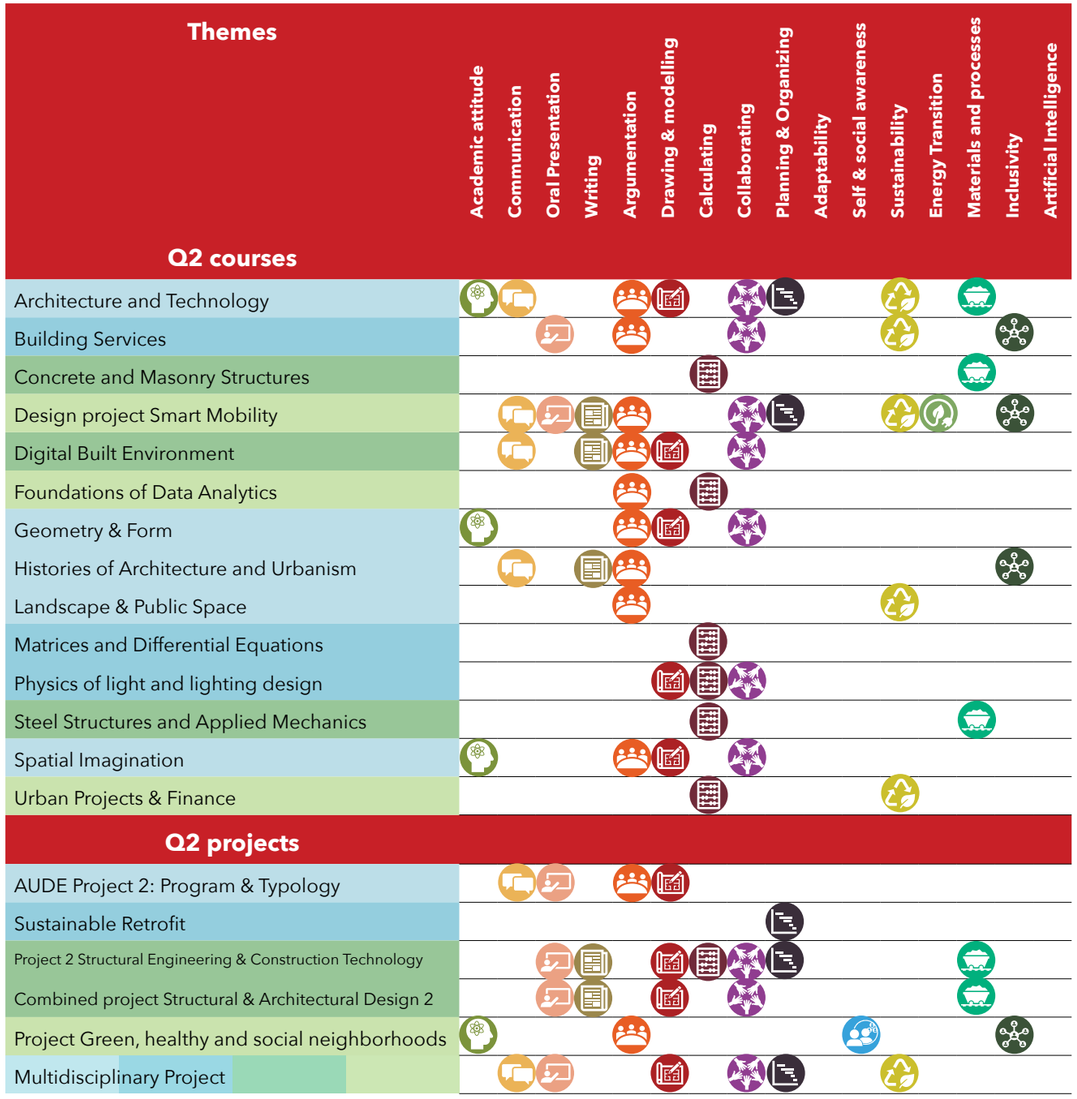
		Quarter 3	Quarter 4
Year 3	BC line	Theories of Architecture and Urbanism Coursecode: 7EA7B20 Level: Advanced Timeslot: A	Project Smart Cities Coursecode: 7EU5B20 Level: Advanced Timeslot: A
		Urban Physics Coursecode: 7B0B20 Level: Introductory Timeslot: C	Urban Case Study Coursecode: 7EA9B20 Level: Introductory Timeslot: C
			Geographic modeling of the built environment Coursecode: 7EU6B30 Level: Introductory Timeslot: B
	Subject Line	**ITEC – Engineering for Society Coursecode: 0LVX20 Level: Deepening Timeslot: B**	**All electives available in this timeslot**
	Research & project Line	Bachelor End Project (10 ECTS) Coursecodes: 7U2B30 Level: Advanced Timeslot: D+E	

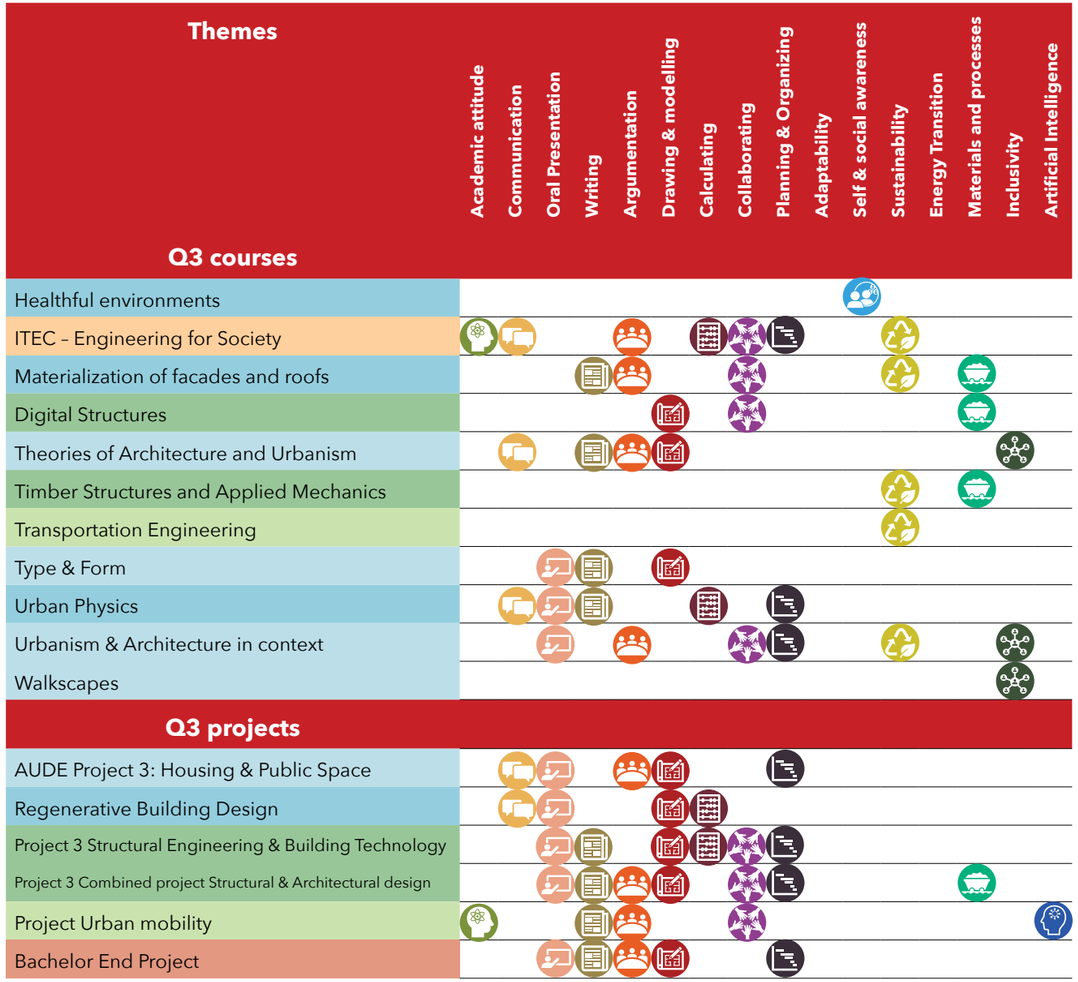
COURSE DESCRIPTIONS SECOND & THIRD YEAR

This section briefly outlines the content of the second & third year courses and projects. These courses constitute the knowledge-base of students ending the Bachelor College curriculum. The following tables briefly show which P&PD and Thematic Learning Areas topics are addressed in which course or project.

Theme	Theme
Academic attitude and dealing with scientific and scholarly information	Planning & Organizing
Communication	Adaptability
Oral Presentation	Self and social awareness & Reflecting
Writing	(Entrepreneurship and) Sustainability
Argumentation and demonstrating understanding	Energy Transition
Visualizing drawing & modelling	Materials and processes
Calculating	Inclusivity
Collaborating	Artificial Intelligence

Themes / Q1 courses	Academic attitude	Communication	Oral Presentation	Writing	Argumentation	Drawing & modelling	Calculating	Collaborating	Planning & Organizing	Adaptability	Self & social awareness	Sustainability	Energy Transition	Materials and processes	Inclusivity	Artificial Intelligence
Building acoustics				■			■							■		
Building Performance	■				■							■	■			
Design for a Sustainable Future	■	■	■		■			■		■	■	■	■	■	■	■
Sustainable Design of Structures			■		■		■	■				■		■		
Dimensioning of structures	■				■	■	■					■	■	■		
Housing, RE & urban Economics	■				■							■				
Making Meaning: Drawing & Modelmaking		■			■			■	■							
Mobility and Forecasting				■				■	■			■				■
Parts & Details						■						■	■	■		
Qualitative Research and Design-oriented Methods	■			■								■	■	■	■	■
Tectonics & Materiality		■	■	■		■						■				
Urban planning	■	■	■	■	■	■						■				
Q1 projects																
AUDE project 1: Making & Structure		■	■		■	■		■	■			■		■		
Building inspection for future-proofing	■		■	■	■					■		■	■			
Project 1 Structural Engineering & Design			■	■	■	■		■	■					■	■	
Combined project Structural & Architectural Design 1			■	■		■		■	■					■	■	
Project Making sustainable real estate feasible	■			■	■			■			■	■				
Multidisciplinary Project		■	■			■		■	■			■				


Themes
Academic attitude
Communication
Oral Presentation
Writing
Argumentation
Drawing & modelling
Calculating
Collaborating
Planning & Organizing
Adaptability
Self & social awareness
Sustainability
Energy Transition
Materials and processes
Inclusivity
Artificial Intelligence
Q2 courses
Architecture and Technology
Building Services
Concrete and Masonry Structures
Design project Smart Mobility
Digital Built Environment
Foundations of Data Analytics
Geometry & Form
Histories of Architecture and Urbanism
Landscape & Public Space
Matrices and Differential Equations
Physics of light and lighting design
Steel Structures and Applied Mechanics
Spatial Imagination
Urban Projects & Finance
Q2 projects
AUDE Project 2: Program & Typology
Sustainable Retrofit
Project 2 Structural Engineering & Construction Technology
Combined project Structural & Architectural Design 2
Project Green, healthy and social neighborhoods
Multidisciplinary Project


Themes
Academic attitude
Communication
Oral Presentation
Writing
Argumentation
Drawing & modelling
Calculating
Collaborating
Planning & Organizing
Adaptability
Self & social awareness
Sustainability
Energy Transition
Materials and processes
Inclusivity
Artificial Intelligence
Q3 courses
Healthful environments
ITEC – Engineering for Society
Materialization of facades and roofs
Digital Structures
Theories of Architecture and Urbanism
Timber Structures and Applied Mechanics
Transportation Engineering
Type & Form
Urban Physics
Urbanism & Architecture in context
Walkscapes
Q3 projects
AUDE Project 3: Housing & Public Space
Regenerative Building Design
Project 3 Structural Engineering & Building Technology
Project 3 Combined project Structural & Architectural design
Project Urban mobility
Bachelor End Project

Themes	Academic attitude	Communication	Oral Presentation	Writing	Argumentation	Drawing & modelling	Calculating	Collaborating	Planning & Organizing	Adaptability	Self & social awareness	Sustainability	Energy Transition	Materials and processes	Inclusivity	Artificial Intelligence
Q4 courses																
City models	●	●	●	●	●	●		●	●		●		●		●	
Experimental research of structures and materials			●	●	●		●	●								
Geographic modeling of the built environment				●												
Project Smart Cities			●	●				●				●	●		●	
Quantitative Research Methods and Statistics	●						●		●			●	●		●	
Room acoustics		●	●	●			●									
Urban Case Study	●	●	●	●	●			●			●					
Q4 projects																
Multidisciplinary CBL					●			●	●		●					
AUDE Project 4: Urban Design & Landscape									●							
Climate-responsive Building Design		●			●					●						
Project 4 Research project in Structural design			●	●		●	●	●	●							
Project 4 Combined project Structural & Architectural design			●	●		●		●	●					●		
Project Urban restructuring	●					●										
Bachelor End Project			●	●	●	●			●							

Themes	Academic attitude	Communication	Oral Presentation	Writing	Argumentation	Drawing & modelling	Calculating	Collaborating	Planning & Organizing	Adaptability	Self & social awareness	Sustainability	Energy Transition	Materials and processes	Inclusivity	Artificial Intelligence
Bouwkundewinkel	●	●	●	●	●	●	●	●	●					●		

Multidisciplinary Project

Course code	Course level	Offered by	Year	Quartile
7P1B30	Advanced	All units	3	Q1&Q2

SHORT DESCRIPTION

The Multi is a project in the third year of the Bachelor of the department of Built Environment (TU/e) and the first encounter with the world of integrated design. Today's building demands have become increasingly complex which necessitates our department to prepare students for a practice in which they are ready to cooperate in design teams in close interaction with all disciplines. The multidisciplinary assignment is a practical assignment designed to train students in solving problems with a high level of complexity. An additional goal is teaching students how to cooperate in a team in which every student takes responsibility for a specific domain.

CONCEPTS

- Design
- Multi disciplinairy
- Context
- Design proces optimalisation
- Planning
- Simulation of the professional field
- Multi tasking
- Spatial configuration,
- Embodied energy
- Urban embedding
- Building desig
- Manufacturability

LEARNING OBJECTIVES

Integral design of a building/complex requires teamwork and is complex in nature: both the number of required expertise and the number of requirements of the design is large, collaboration is essential.

After completing the Multi project, the student is capable of:

- In a team developing a joint vision as an answer to a design assignment and translate it into a program of requirements
- To organize an integral design process in such way that the student can achieve a disciplinary depth into his/her individual discipline and also integrate this into the team's final outcome.
- To meet the specified requirements of the final product (see also product) Product: (Technical) elaboration of the building/complex for your expertise and for your relevant requirements. The core is that you demonstrably apply your expertise and make it concrete in the integral design that includes all disciplines

After completing the Multi project, the student can:

- Generate and evaluate alternative concepts
- Demonstrate that the chosen and elaborated concept meets the program of requirements (substantiating it with calculations, simulations, drawings, etc.)

Presenting the design - The student is able to:

- Provide a clear presentation of the design on key issues for a (large) group (during the carousel)
- Clearly display the design in drawings, text, posters and models

Architecture and Technology

Course code	Course level	Offered by	Year	Quartile
7A0B30	Deepening	AUDE	3	Q2

SHORT DESCRIPTION

This course focuses on the translation of an architectural idea into an architectural detail. The student will learn to make detail drawings of a given design, adapting it to his/her own clearly defined conceptual thoughts.

CONCEPTS

- Architecture
- Bio-based material
- Building mass
- Building material
- Circulation
- Concept, Design concept
- Dimensioning
- Emerging technologies
- Insulation materials
- Material application
- Material circularity
- Sketch
- Spatial confuration
- Stability, Tectonics
- Thermal bridges
- Thermal properties of materials
- Water vapor barriers
- Window properties

LEARNING OBJECTIVES

With a variety of (guest)lectures the student will develop insight into:

- The makability of the architectural design
- The influence a detail design can have on architecture
- Interpretations of design briefs and -processes
- The influence of the architectural concept on the detail

Furthermore, after completing this course, the student will be able to:

- Apply a selection of the discussed themes in a simple technical design
- Work on a design to a level of elementary details
- Elaborate details which support the architectural concept
- Be critical about one's own position, approach, interpretation and affections within the field of architecture relating to its makability
- Look at buildings in an analytical way and explain their relation to the detail
- Apply a selection of the discussed themes in a detailed survey of a given design

AUDE project 1: Making & Structure

Course code	Course level	Offered by	Year	Quartile
7PA1B20	Deepening	AUDE	3	Q1

SHORT DESCRIPTION

The second year Design project-line is aimed at expanding students' basic knowledge and skills of architectural and urban design.

The first project focusses on technical elaboration within a range of scales from 1:500 to 1:1. The project is divided into 4 parts: structure, form, components and synthesis. The students perform research, analysing the site, the program, a reference project and they will study relevant literature. In workshops the students will make and explore research models; the design part structures the given design brief, placing it on a small plot, exploring form and the making of space by thinking of the character of the chosen material and construction method. The themes of seasonality and the notion of time passing over a period of seven years will will stimulate thinking in terms of the physical weathering and transformation of materials and structures.

CONCEPTS

- Structure
- Program
- Function
- Spatial Quality
- Temporary Buildings
- Material, Structural Design
- Architectural Detail
- Daylight
- Loadbearing Structure
- Tectonics
- Interior/Exterior
- Section
- Plan
- Elevation
- Facade Section
- Architectural Model

LEARNING OBJECTIVES

At the completion of this project the students should have knowledge and insight in:

- Fit your design into its context in a well-reasoned way
- Define the proportions of spaces and the configuration and sequence of spaces in a well-reasoned way
- Design the building envelope, based on the desired light quality and relation between inside and outside, etc
- Design the structure and architectonic details, taking into consideration the qualities of the chosen materials, and how those materials are processed in construction
- Integrate the different aspects of your architectural design into a complete & coherent proposal
- Present your design proposal in a clear way (presentation)
- Produce correct and coherent architectural basic drawings (plans, sections, elevations) with an appropriate level of precision and detail
- Produce correct and coherent architectural technical drawings (combination drawing and details) with an appropriate level of precision and detail
- Produce appealing perspective and/or axonometric 3D visualizations, that convey the spatial qualities of your design
- Produce physical models with an appropriate level of precision and detail
- Produce graphically balanced project posters and a project booklet
- Deliver a concise oral presentation, conveying the qualities of and ideas behind your design
- Independently and self-critically develop your design proposal (process)
- Critically reflect on your work, recognize, define and analyze design problems, and use feedback constructively
- Explore possible solutions by developing alternatives and variants, evaluate solutions, and make well-reasoned design choices, based on principles and guiding themes/concepts as defined by you
- Make use of various types of physical models and sketches (resulting from the workshops) to develop the different aspects of your design
- Draw relevant lessons and insights from a reference study
- Keep control over your design process and planning

AUDE Project 2: Program & Typology

Course code	Course level	Offered by	Year	Quartile
7PA2B20	Deepening	AUDE	2	Q2

SHORT DESCRIPTION

The second year Design project-line is aimed at expanding students' basic knowledge and skills of architectural and urban design. The second project focusses on a complex programatical translation into a elaborated design within a range of scales from 1:500 to 1:20. In an existing context we ask to design a public building with a complex design brief. The project is divided into 4 parts: organizing program, compose spaces , zooming in to a part and a final synthesis into a final design proposal. The students perform research, analysing the site, the program, a reference project and they will study relevant literture. In workshops the students will make and explore physical research models; The design evolves by organizing the program, composing it into spaces and zooming in to a part. The end product will be a synthesis of these three activities: organizing, composing and zooming in.

CONCEPTS

- Program
- Relationship Diagram
- Function
- Spatial Quality
- Context
- Concept
- Buildingype
- Public Buildings
- Building Mass, Material
- Daylight
- Loadbearin
- Structure
- Tectonics
- Interior/Exterior
- Section
- Plan
- Elevation
- Facade Section
- Architectural Model

LEARNING OBJECTIVES

After successfully completing this course, you will be able to:

- Translate a design brief into a design proposal for a medium sized public building in a complex urban environment (product)
- Creating order in a complex public building, organizing the configuration and sequence of spaces, taking into consideration notions of ‘public quality’
- Fit your design into its urban context, taking into consideration the (public) spaces created around the building, and their relation to the interior
- Define the form and proportions of spaces and their desired atmosphere/quality
- Design the building envelope, based on the desired light quality and relation between inside and outside, etc.
- Design the loadbearing structure, and elaborate the architectonic design of the interior and exterior of the building, taking into consideration the qualities of the chosen materials
- Integrate the different aspects of your architectural design into a complete and coherent proposal
- Present your design proposal in a clear way (presentation)
- Produce correct and coherent architectural basic drawings (plans, sections, elevations) with an appropriate level of precision and detail
- Produce correct and coherent architectural technical drawings (combination drawing) with an appropriate level of precision and detail
- Produce appealing perspective and/or axonometric 3D visualizations, that convey the spatial qualities of your design
- Produce physical models with an appropriate level of precision and detail
- Produce graphically balanced project posters and a project booklet
- Deliver a concise oral presentation, conveying the qualities of and ideas behind your design
- Independently and self-critically develop your design proposal (process)

AUDE Project 2: Program & Typology

Course code	Course level	Offered by	Year	Quartile
7PA2B20	Deepening	AUDE	2	Q2

LEARNING OBJECTIVES

After successfully completing this course, you will be able to:

- Critically reflect on your work, recognize, define and analyze design problems, and use feedback constructively
- Explore possible solutions by developing alternatives and variants, evaluate solutions, and make well-reasoned design choices, based on principles and guiding themes/concepts as defined by you
- Make use of various types of physical models and sketches (resulting from the workshops) to develop the different aspects of your design
- Draw relevant lessons and insights from a reference study
- Keep control over your design process and planning

Your assessment for this course is aimed at evaluating the extent to which you have achieved these learning objectives.

AUDE Project 3: Housing & Public Space

Course code	Course level	Offered by	Year	Quartile
7PA3B20	Deepening	AUDE	2	Q3

SHORT DESCRIPTION

This project is aimed at expanding basic knowledge and basic skills of architectural and urban design. This project focuses on the urban and architectural plan in the scale range from 1:500 to 1:100.

CONCEPTS

- City
- City Block,
- Plot
- Context Analysis
- Mas Study
- Housing Typology
- Circulation
- Dwelling Layout
- Façade
- Private/Collective/Public Space
- Material
- Daylight
- Loadbearing Structure
- Tectonics
- Interior/Exterior
- Section
- Plan
- Elevation
- Facade Section
- Architectural Model

LEARNING OBJECTIVES

After successfully completing this course the student will be able to:

- Design a housing block within an ensemble in a complex urban environment
- Present the design proposal in a clear and convincing way
- Independently and self-critically develop the design proposal

AUDE Project 4: Urban Design & Landscape

Course code	Course level	Offered by	Year	Quartile
7PA4B20	Deepening	AUDE	2	Q4

SHORT DESCRIPTION

In the second year project 4 you will focus on the design of a residential district in the city. The project is aimed at expanding basic knowledge and basic skills of architectural and urban design. This project focuses on the urban masterplan in the scale range from 1:5000 to 1:500

CONCEPTS

- Urban Analysis
- Urban Design
- Urban Structure
- Urban Morphology
- Neighbourhood Planning
- Public Space Design

LEARNING OBJECTIVES

After successfully completing this course the student will be able to:

- Perform an elementary urban analysis and apply the findings to both the critical interpretation of the design task and the design itself
- Design the general layout of a residential neighbourhood with attention to the surrounding context the structure, hierarchy, and zoning
- Distinguish between typo-morphological models and apply them in design
- Design a functional and pleasing public space
- Align analysis and design decisions across different scale levels with consideration to mobility, health and sustainability
- Present the plan concisely regarding the aspects above

Bachelor End Project AUDE

1 architecture, AUDE 2 urbanism and architecture

Course code	Course level	Offered by	Year	Quartile
7A2B30	Advanced	AUDE	2	Q3&Q4

SHORT DESCRIPTION

The Bachelor End Project is the individual final piece of the Bachelor's program. During the BEP you show that you are able to execute a design a/o research project, based on requirements and self-developed insights. The level of the end-project reflects the learning-outcomes of the BSc AUBS

CONCEPTS

- Research context and themes
- Formulate research question for design project
- Relate proposed design to research question
- Elaborate design from urban scale towards building scale
- Research Question
- Analysis, Mapping
- Architectural Themes
- Attitude
- Existing Buildings
- Transformation
- Revitalisation,
- patial Qualities
- Daylight
- Public Buildings
- Context
- Urban Fabric
- Function
- Housing
- Structure
- Materials
- Tectonics
- Interior/Exterior
- Section
- Plan
- Elevation
- Facade Section
- Architectural Model

LEARNING OBJECTIVES

During the Bachelor End Project you show that you are able to:

- To execute a design a/o research project under limited supervision. By research the student defines own themes and rewritten program and context as a base for the design. The relationship between research and design is strong. the design is related in all scales
- To present the results in ppt presentation, models and 2 A1 synthesis posters that clearly shows the essence of the design
- To develop and carry out a solid process by writing a report on the answer design gives to the research question and a report on a reflexion on the planning during the process

Bouwkundewinkel

Practical assignment

Course code	Course level	Offered by	Year	Quartile
7ES3B20	Introductionary	All units	2&3	Q1&Q2&Q3&Q4

SHORT DESCRIPTION

- The Bouwkundewinkel gives students the opportunity to put their knowledge into practice. Practical problems and design questions with a real client are translated into research assignments. To give students practical experience and provide the client with feasible solutions for the problem or design question. Since real problems/design questions are solved the subject of the assignments changes each quartile, depending on the requests that the Bouwkundewinkel receives. The Bouwkundewinkel has assignments that relate to the different disciplines within the Built Environment: Architecture, Structural Engineering and Design, Urbanism, Real Estate and Building Physics. All assignments are supervised by a teacher from the involved discipline. The Bouwkundewinkel is an organization managed by students.

CONCEPTS

- Research
- Architectural Design
- Structural Design
- Building Physics
- Urban Design
- Real Estate
- Building Technology

LEARNING OBJECTIVES

Upon successful completion of the course: Practical assignment ""Bouwkundewinkel"", students will be able to:

Product

- Analyze a practical problem or design question of a client and translate this into a research project
- Collect relevant information using different research methods (e.g. inquiries, literature study or measurements)
- Generate several alternatives with explanations for the decision-making process
- Generate a feasible solution for the practical problem or design question for a client
- Clearly and concisely present research/design outcomes in written, visual (drawings, model) or oral form for a client outside the field of the Built Environment

Process

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Effectively plan and execute a limited research and design project within defined timelines
- Actively participate in a group with the goal of learning
- Communicate clearly and regularly with a client outside the field of the Built Environment

City models

Course code	Course level	Offered by	Year	Quartile
7EA10B20	Advanced	AUDE	3	Q4

SHORT DESCRIPTION

Together with the course Theories of Architecture and Urbanism the course explores the relation between the design (architectural and urban) and the ideological, societal and cultural forces that has shaped - and will keep shaping - the built environment.

In the tutorial we study the relations between spatial conditions and ideologies and theories through the creation of drawings and models that are the same time aesthetical and critical.

In the course (being the last and most advanced of the three bachelor analysis courses) the analysis is taken to deepening levels of interpretation and reflection, requiring creativity and an independent approach of the analysis methods.

CONCEPTS

- Architecture
- Urbanism
- Type
- Morphology
- Scale
- Form
- Shape
- Order
- Mapping
- Pattern
- Language
- Space
- Place
- Threshold
- Domain
- Function
- Atmosphere
- Making
- Representation
- Context
- Medium
- Tools
- Practice
- Power
- Humanism
- Aesthetics
- Spectacle
- Memory
- Technology
- Nature
- Sustainability
- Territory
- Utopia
- Ideology
- Model
- Application
- Transformation
- Analysis
- Mapping
- Cartography
- Observation
- Deconstruction
- Reduction
- Abstraction
- Classification
- Interpretation
- Creativity
- Reflection
- Criticism

LEARNING OBJECTIVES

Students who have successfully finished the course are able to:

- Understand and interpret the provided sources (text ánd drawings!), and to expand the information on the cases with relevant other sources
- Apply the methodology of literature analysis and plan analysis and (morphological reduction) in a critical and (self)reflective way
- Identify and explain the relations between (changes in) urban forms, and the social, economic, political and cultural backgrounds of these changes
- Identify and explain the differences and relations between ideal and realized city concepts and their significance in the history of urban planning and architecture
- To deploy abstraction (of text ánd drawings) in order to structure, compare and interpret information on complex urban processes, and to characterize the relation between these processes and the actual shape of the city
- Create analytical drawings (2D & 3D) and models (physical) that identify and explain the historical and spatial development of the studied city. Here the student is also able to combine and compare abstract and physical representations
- Give a concise, well-structured presentation using a well-balanced combination of drawings, models (physical) and verbal explanation, using these three means in a complementary way
- Write a well-structured report, with clear conclusions, using both images and verbal explanation in a complementary way
- Collaborate on a well organised and effective way
- Deploy group discussions and group work (including comparison of an reflection on individual contributions) to come to deeper understanding and better explanation of the studied material

Design for a Sustainable Future

Course code	Course level	Offered by	Year	Quartile
7EA1B20	Introductory	AUDE	2	Q1

SHORT DESCRIPTION

Addressing the numerous global challenges locally is key to sustained prosperity. If your mission is to innovate sustainably, this course provides you with special skills, knowledge, and thinking to navigate today's complexity and design solutions that contribute to a sustainable future.

CONCEPTS

- Comprehensive history of human and sustainability-thought development from a political-economic and evolutionary perspective, explaining among others the need for and development of sustainability frameworks like the Sustainable Development Goals (SDGs), 'think globally, act locally', the planetary boundaries framework, and the Doughnut Model
- Systems thinking basics, including mapping a system, identifying components and interactions, feedback loops, and leverage points for change
- Basics of critical thinking and design thinking, including the concept of design sprints and life-centred design, How-Might-We questions, programmatic design brief
- Transition science basics, including complexity and types of problems (simple, complicated, complex, wicked), why change is difficult, multi-level perspective (MLP), Strategic Niche Management (SNP), risk and opportunity analysis, mission-led innovation, visioning, scenario planning

LEARNING OBJECTIVES

Students who have successfully finished the course are able to:

- Describe and explain the why, how and what of sustainable development, including urgency, concepts, frameworks, and perspective
- Have a compass supporting informed and critical design decision making regarding sustainable development in different context
- Methodically devise a comprehensive design brief that is based in mission-led innovation, translating a global challenge into a manageable local project

Geometry & Form

Course code	Course level	Offered by	Year	Quartile
7EA3B20	Introductory	AUDE	2&3	Q2&Q4

SHORT DESCRIPTION

In this course we address the relationship between the abstract and the tangible world. In order to understand this relationship basic geometrical concepts are transformed into physical objects. What do mathematical concepts have to offer and what are their limitations when being transformed into a physical object. What are the possibilities and constraints when making tangible objects based on geometrical concepts?

CONCEPTS

- Geometry (point, line, plane, distance, angle, intersection etc.)
- Concept
- Abstract
- Drawing
- Concrete
- Object
- Perception
- Expression
- Architecture

LEARNING OBJECTIVES

Design is partly about turning ideas into physical objects. The goal of this course to increase your understanding of the difference between the abstract and the concrete world. In transforming geometric concepts into materialized objects, you inevitably encounter problems arising from the properties of the material and the characteristics of making. You will learn how to conceive these ‘problems’ as opportunities. Materials and the process of making are ‘carriers of meaning’. You will learn how these meanings provide the opportunity to relate initially abstract geometric concepts to each other. These relationships can also be poetic, in the sense that the different geometric forms begin to resonate with each other. In summary, you will learn human thought and action can contribute to a meaningful world.

At the end of the course you will be able to:

- Apply geometrical concepts and calculations in order to create a physical object
- Understand the complex relationship between the abstract and the tangible world, between geometry and a materialized objects
- Relate an abstract idea to the possibilities and limitations of materials and the making of a physical object
- To establish meaningful and even poetic relations between objects

Histories of Architecture and Urbanism

Course code	Course level	Offered by	Year	Quartile
7A1B20	Advanced	AUDE	2	Q2

SHORT DESCRIPTION

From antiquity to the present, architecture and urbanism have not only reflected and shaped the cultural, political, and economic contexts of various times as well as directly contributed to the formation of cities and societies. Understanding the historical relation between architecture, urbanism, and society provides crucial context for understanding architecture and the city.

CONCEPTS

Focus on the following periods:

- Ancient Egypt, Greece and Rome
- Asian, American and African architectural traditions
- Medieval, Gothic, and Islamic, Renaissance and Baroque
- Enlightenment and Industrial
- Modern and postmodern
- Contemporary and Global

Along with critical discussions on:

- Global perpectives
- Critical analysis of the architectural and urban canon
- Gender, power, and representation
- Colonial-postcolonial
- Energy and sustainable practices

LEARNING OBJECTIVES

Upon completion of this course, students will be able to:

- Identify the major historical themes, ideas, and vocabulary of European architecture and urbanism
- Classify and compare different underlying concepts by recognizing their diverging architectural and urban expressions
- Analyze and compare different architectural and urban periods and their physical expression.
- Develop a theoretical and historical framework to critically approach architecture and urban culture
- Use typological and morphological analytical skills to assess the different qualities of historical concepts

Landscape & Public Space

Course code	Course level	Offered by	Year	Quartile
7EA2B20	Deepening	AUDE	2	Q2

SHORT DESCRIPTION

Landscape Architecture is a process-oriented discipline par excellence and is synchronized with the history of the Netherlands. The discipline as we know nowadays starts at the 17th century. The contemporary landscape discipline coincides with the post-war city. Since the 90s, the discipline stands in the spotlight by the renewed focus on the urban public space.

CONCEPTS

Sustainable development goals:

- Quality of life
- Healthy living environment, soil and water management
- Climate resilient cities
- City concepts
- Green cities and plant communities
- Land use
- Urbanization
- Spatial interaction

LEARNING OBJECTIVES

On completion of the course students will be able to:

- Analyze the different landscape typologies of the Netherlands and is able to give a description of each landscape typology
- Analyze the different typologies of the public space and must is able to give a description of each typology
- Argue the importance and functions of urban green
- Analyze typologies and different organizations of urban green
- Analyze the Dutch landscape. The student can reconstruct the geological history in meaning and time and appoint different landscape shaping factors
- Explain the history and development of public space in Dutch cities. The student can appoint the different stages of development and meaning

Making Meaning: Drawing & Modelmaking

Course code	Course level	Offered by	Year	Quartile
7EA0B20	Deepening	AUDE	2	Q1&Q3

SHORT DESCRIPTION

In a series of consecutive drawing and modelmaking exercises you hone your ability to convey ideas that are central to a (design for a) building, or to a spatial environment smaller or bigger than that (a room, a square). An idea as meant here can be any coherent mental representation of a part of reality. Meaning emerges when your drawings and models reveal these ideas.

CONCEPTS

- Making
- Meaning

LEARNING OBJECTIVES

After completing the course the students are able:

- To determine appropriate means to present a specific architectural or urban design in drawings and models
- Make models that convey the ideas that are central to a design or a building
- Make drawings that convey the ideas that are central to a design or a building

Parts & Details

Course code	Course level	Offered by	Year	Quartile
7A0B20	Introductory	AUDE	2	Q1

SHORT DESCRIPTION

How to design well-engineered (and architecturally sensitive) building parts such as foundations, structures, facades, roofs, windows, alone and in combination? This course analyzes and exercises multiple examples, primarily from technical point of view, but also with regard to sustainability and aesthetics.

CONCEPTS

- Substructure
- Structure
- Foundation
- Basement
- Skeleton
- Frame
- Floor
- Connection
- Detail
- Stacking
- Assembling
- Casting
- Facade
- Facade Opening
- Frame
- Reveal
- Curtain Wall
- Cavity Wall
- Clad Wall
- Plastered Wall
- Roof
- Infrastructure
- Suspended Ceiling
- Separation Wall
- Strength
- Stiffness
- Stability
- Tolerance
- Thermal Insulation
- Thermal Break
- Vapor Proofing
- Waterproofing
- Frost Proofing
- Fireproofing
- Soundproofing

LEARNING OBJECTIVES

After completing the course the students can:

- Design (combinations of) a wide variety of technically adequate (and architecturally sensitive) building components (i.e substructures, lightweight structures, solid structures, roofs, facades, facade openings and interior systems) with the help of reference material
- Explain the parts and details in your designs with regard to their technical performance (and architectural choices)
- Make technical drawings (i.e. 2D sections and 3D projections) according to industry standards, to define and communicate your design

Qualitative Research and Design-oriented Methods

Course code	Course level	Offered by	Year	Quartile
7A3B20	Advanced	AUDE	2	Q4

SHORT DESCRIPTION

Research is part of the professional life of architects, urban designers, planners, and engineers. This course offers an overview of various types and practices of qualitative and design-oriented research methods within the field of built environment. The research methodologies currently being applied in the built environment are closely associated to those applied in other disciplines within cultural, social, economic and environmental sciences, while often addressing existing societal challenges. Students will conduct a systematic literature review (SLR) on a topic of their interest. As part of the SLR, they will distinguish and argue the differences in context and methodological approach in existing studies that will reported in verbal, visual and textual components (conference paper and presentation).

CONCEPTS

- Qualitative Research Method
- Research Design
- Design-Oriented Research
- Research Process
- Systematic Literature Review
- Scientific Paper Writing

LEARNING OBJECTIVES

At the end of this course, the students will be able to:

- Conduct a systematic literature review and apply a pre-defined literature grid, identifying the main aim and objectives, methodology, results and conclusions of published research
- Report in writing, a comparative analysis on research methodologies, as well as, a discussion on their reliability given the research aim and objectives
- Report orally and visually, a comparative analysis on research methodologies, as well as, a discussion on their reliability given the research aim and objectives
- Apply standards of quality by means of peer-review, suggest improvements of performance, and reliability

Spatial Imagination

Course code	Course level	Offered by	Year	Quartile
7EA6B20	Introductory	AUDE	3	Q2

SHORT DESCRIPTION

The purpose of this course is learning to look critically at the notion of space. That means re-addressing perceptual habits, learning to observe analytically and critically, and exploring how to represent spatial experiences. The student will gain understanding of how a work of art and architecture is produced and how the observer responds to it. The course consists of three parts: seminar, lecture, and workshop. Lectures will provide a philosophical angle to enrich your spatial understanding. In workshops, you will acquire knowledge and skills and practice through drawings (analog and digital). In the seminar part, you will work in groups of four to develop a spatial concept. The theme (focus) can change from year to year. Students will research (2d, 3d, 4d) and reflect on understanding and exploring the relationship between real and virtual space.

CONCEPTS

- Experiencing Space/ by “Observation”
- Drawing Systems/ by “imagination”
- Portrait & Composition
- Light & tone in 3D (in space itself) & 2D images
- Form- residual form
- People in Space
- Gradients & Space
- Koolhaas’ problem: space as a device in architectural design
- Filippo Brunelleschi and the invention of constructed perspective.
- Imagined perspective
- Symbolic perspective
- Narrative perspective
- Observed perspective
- Raumgefuhl und Raumphantasie, Raumgestalterin
- Kenon: Emptiness and Fullness:
- Medieval Space (C.S. :Lewis)
- Apeiron: Infinity
- Absolute space of Descartes, or Cartesian Space
- Space as a concept of the understanding, Immanuel Kant
- The body and its production of space, Henri Lefebvre:
- Real Space vs Virtual Space, David Summers
- Logical Space, the picture theory of language and relation, Wittgenstein
- Mapping and measuring space
- Chaos/Cosmos: Structure, Continuity and Division, Segmentation and Sequence
- Smooth Space and Striated Space (Deleuze & Guattari)
- Topos: thinking and place
- Temenos: Mythical Space: Breaking and tearing space: the sacred and profane, epiphany and hierophany, event & initiation, hierarchy, axis mundi, transcendence & allegory
- Womb Space: Enclosure protection and security
- The Frame (Gestell)
- Control Space: The Dispositive &
- Space and Affordance,
- Utopia and Heterotopia
- Spatium, interval,
- Harmonia, fitting
- Composition & Arrangement: the portraiture of space & event (Simone Weil)
- Desire space: the powerful, the erotic and the distasteful
- Chara: space of becoming
- Choreography: movements and flowing space
- Sequences and scenography, The proscennium, coulisse, the mis en scene,
- Filmic Space: The notion of a journey.by “Observation”

Spatial Imagination

Course code	Course level	Offered by	Year	Quartile
7EA6B20	Introductory	AUDE	3	Q2

LEARNING OBJECTIVES

The purpose of this course is to help students learn to observe analytically, critically and creatively. At the end of the course you will be more refined in your spatial awareness. You will learn to use a specialist set of spatial concepts and demonstrate the refined understanding they make possible. Furthermore you will be invited to explore meaning through language and image and so begin to understand how the representation and perception of space are in fact expressions of yourself in relation to the object and that this holds not only when you express yourself in images, but even when you perceive and interpret images created by others. We cannot do this adequately without exploring the cultural conditions and social mechanisms under which a work of art performs its magic and how it reacts to time and place. In short students will develop a critical apparatus regarding the production of space that will help them refine their professional interest in the design and production of a built environment.

At the end of this course the student is able to:

- Identify, define, contextualize, and illustrate a set of spatial concepts
- Apply and practice spatial experiences through analyzing and critiquing works of art and design
- Explore the cultural and social meaning of spatial experiences
- Represent spatial concepts, interactions, and ideas through visuals (drawings) and thought experiments
- Use these spatial insights to analyse and critique their own design decisions
- Find, Explore and evaluate the relationships between the historical material studied and the student's efforts in the representation of space
- To apply specific visual rhetorical techniques in the production of the representation of space
- Adopt and describe an analytical and critical attitude to one's own work

Tectonics & Materiality

Course code	Course level	Offered by	Year	Quartile
7EA5B20	Advanced	AUDE	2&3	Q1&Q3

SHORT DESCRIPTION

This course aims at introducing the concept of tectonics in architecture, by focusing on

the relationship between expression, making and material. This relationship is explored through physical artifacts. What is the difference in expression of objects composed of the same material but made in different ways? What is the difference in expression of objects composed of different materials but made in the same way? Different tectonic positions are associated with examples from architecture.

CONCEPTS

- Materials
- Making
- Tectonics
- Appearance
- Architecture
- Atmosphere

LEARNING OBJECTIVES

At the end of the course, the student will be able to:

- Recognize and describe the basic tectonic position of an object or existing building
- Understand the relationship between, on the one hand, technique, construction and attributes of materials and, on the other hand, appearance and expression
- Express a tectonic position in a self-made artifact

Theories of Architecture and Urbanism

Course code	Course level	Offered by	Year	Quartile
7EA7B20	Advanced	AUDE	3	Q3

SHORT DESCRIPTION

Architectural and urban theories have been used throughout history not only as a tool to understand changes to the built environment, but also to—rather purposefully—shape them. By discussing the context and the expression of various architecture and urban theories, it will become evident how these have consistently aimed at changing society through architecture and urbanism.

CONCEPTS

- Medium
- Tools
- Practice
- Power
- Humanism
- Aesthetics
- Spectacle
- Memory
- Technology
- Sustainability
- Territory
- Utopia

LEARNING OBJECTIVES

Upon completion of this course, students will be able to:

- Identify significant theories of architecture and urbanism as well as their societal impact
- Critically evaluate different underlying concepts by recognizing their diverging architectural and urban expressions as well as their social, economic, cultural and political impact
- Develop a theoretical framework to critically understand the various dimensions of architecture and urbanism along with their social, cultural, political and economic expression

Type & Form

Course code	Course level	Offered by	Year	Quartile
7A2B20	Deepening	AUDE	2	Q3

SHORT DESCRIPTION

The relationship between and the meaning of ‘type’ and ‘form’ is analyzed through four scales. The scale of the city fabric, the scale of the neigborhood, the scale of the block and the scale of the dwelling. Per scale different (sub)themes are relevant. Analysis (analytic and intuitive) is done by drawing, modelmaking and writing.

CONCEPTS

- Type
- Morphology
- Scale
- Form
- Observation
- Order
- Mapping
- Pattern
- Language
- Space
- Place,
- Threshold
- Domain
- Function
- Atmosphere
- Representation
- Context
- Mapping
- Reduction
- Abstraction
- Classification
- Interpretation
- Urban fabric
- Neigbourhood
- Block
- Dwelling

LEARNING OBJECTIVES

Students who have successfully finished the course are able to:

- Identify the different scales (city scale, neigborhoodscale, building block scale and the scale of the dwelling) and relate them to each other
- Describe, explain and apply the important conceptual thoughts and the key spatial elements of the analyzed city fragments
- Create analytical drawings and models that describe and relate type and form and their social, economic, political and cultural backgrounds

Urban Case Study

Course code	Course level	Offered by	Year	Quartile
7EA9B20	Introductory	AUDE	3	Q4

SHORT DESCRIPTION

A key prerequisite for dealing with todays complex urban problems is a sound city diagnosis. In this course you learn how to diagnose a city of your choice in a holistic way, putting you in a position to wisely pick your priorities.

CONCEPTS

- City basics, including daily urban system, city network, city and regional governance, housing market, regional economy, urban infrastructure systems (including energy grids, data-storage and circular waste systems), public services, social conditions (indicators of community flourishing versus community decay, public health), and political geography.
- Diagnosis, root cause analysis, critical and systems thinking as opposed to fallacious thinking, leverage points for action, programmatic design brief

LEARNING OBJECTIVES

After completing the course the students are able to

- Identify current urban trends in cities in light of global political-economic, technological and ecological change
- Analyse a city from multiple perspectives in its regional and international context.
- Identify key urban issues in a city and their root causes
- Methodically devise a design brief for a strategic project that leverages desired change
- Convincingly communicate the city diagnosis and design brief to tutors posing as city decision makers

Urbanism & Architecture in context

Course code	Course level	Offered by	Year	Quartile
7EA4B20	Deepening	AUDE	2	Q3

SHORT DESCRIPTION

The key purpose of 'Urbanism and Architecture in Context' is to introduce the field of urban design and planning, which aims to re-create a balanced system so that people, nature and society

are able to coexist in harmony and prosperity. It provides a foundational knowledge on the context, methods and products of urban design and planning.

CONCEPTS

- City as a system, urban design and planning, urban form, scales, layers and sectors
- Drivers of urban change (agents and processes)
- Urban design paradigms, values of good urban form, place and placemaking, urban form and human-nature relationships, competitiveness and neoliberal urbanism
- Urban stakeholders
- Visioning, narrative scenarios
- Adaptability and flexibility
- Context of urban design, urban analysis, location types, density and typology, framework plan
- Data collection, GIS, mapping (thematic maps, geoprocessing, network analysis, space syntax, walkthrough surveys)
- Domains (public, semi-public, private), public space, thresholds and transitions, housing typologies, human scale

LEARNING OBJECTIVES

By the end of the course, the students will be able to:

- Explain the role of urban design and the need for it in the face of existing and emerging social, technological, environmental, economic and political issues
- Explain certain concepts and professional terminology used in the field of urban design
- Indicate the links between urban form and social, technological, economic, environmental and political (STEEP) drivers at different scales
- Identify a number of urban design and planning paradigms
- Identify the stakeholders in urban design and their roles
- Describe several methods and tools used for urban design and sample generated products
- Identify urban form components and structures and their spatial characteristics at different scales
- Produce a neighborhood vision based on urban analysis
- Identify the relationship between various housing typology and public space

Walkscapes

Course code	Course level	Offered by	Year	Quartile
7EA8B20	Advanced	AUDE	3	Q3&Q4

SHORT DESCRIPTION

Walkscapes is an advanced course for designers who want to explore the more subjective way of analysis of a self chosen theme. Literature study, analysis through observation (and recording on film), critical thinking and representation are key values for this course.

CONCEPTS

- Experience
- Behaviour
- Observation
- Exploration
- Flaneur
- Art
- Culture
- Politics
- Walking
- Psychogeography
- Imagination
- Atmosphere
- Dérive
  Intuition
- Emotion
- Narrative
- Diversity
- Inclusivity
- City (life)
- Identity
- Society
- Surrealism
- Behaviour
- Promenade
- Framing
- Perception
- Space
- Event
- Voyeurism
- Montage
- Sequence
- Senses
- Vision
- Memory

LEARNING OBJECTIVES

Students who have successfully finished the course are able to:

- Describe, use and relate subjective methods of analysis (for instance observing, walking, filming)
- Develop and demonstrate their critical thinking
- Analyze their self chosen theme using and experimenting with different techniques and select the best technique to represent the theme in the final exhibition (the final piece of work should represent the central ideas)

Bachelor End Project BPS

Course code	Course level	Offered by	Year	Quartile
7B2B30	Advanced	BPS	3	Q3&Q4

SHORT DESCRIPTION

The Bachelor End Project is an individual project and constitutes the final part of the Bachelor program. During the BEP you show that you are able to execute a design a/o research project, based on requirements and self-developed insights. The level of the end-project reflects the learning-outcomes of the BSc AUBS.

CONCEPTS

- Research (verb)
- Design (verb)
- Retrofitting
- Project-based work
- Building inspection
- On-site measurements
  Advanced calculations or simulation tools
- Optimisation measures
- Reporting
- This will include concepts tailored to the specifc interests of the student

LEARNING OBJECTIVES

During the Bachelor End Project you show that you are able to:

- Execute a design a/o research project under limited supervision
- Present the results in a written report and by oral presentations
- Develop and carry out a solid process

More in detail:

When carrying out the design cycle, you show that you are able to:

- Analyse the assignment and project hand-outs
- Draft a program of requirements (pve)
- Develop a concept
- Elaborate on the concept
- Develop an aspect
- Evaluate the concept/aspect on the pve.

When carrying out the design cycle, you show that you are able to:

- Analyse the assignment and project hand-outs
- Formulate a research goal and research questions
- Draft a conceptual model
- Elaborate by research tools a/o measurements
- Collect and analyse data
- Interpret of the results
- Evaluate the results on the research goal and research questions

While working in groups, you show that you are able to

- Show professional behavior (act creative, reliable, accurate, perceptive and independent)
- Coordinate group tasks
- Develop project-based initiatives and systematic workflows
- Reflect on your own work and evaluate its integration into the project
- Form opinions and provide feedback to work of others

Building acoustics

Course code	Course level	Offered by	Year	Quartile
7EB0B20	Introductory	BPS	2	Q1

SHORT DESCRIPTION

Driven by the continued global increase in traffic and the degree of urbanization, noise problems in and around buildings are becoming increasingly prevalent. Protecting people from noise by ensuring sufficient sound insulation is therefore important. The overarching goal of this course is to introduce building physics concepts regarding sound transmission and sound radiation, such that the airborne and impact sound insulation in a building can be analyzed, predicted, and improved. Students will acquire knowledge and develop skills through lectures, tutorials, and an assignment in which they will analyze the acoustic performance of a building (part).

CONCEPTS

- Importance of building acoustics: avoiding transmission of unwanted noise such as originating from traffic or neighbors and supporting desired sound such as speech and music; new powerful sound sources; increased awareness of noise
- Knowledge on building acoustics: building acoustic quantities, mechanical vibrations, sound reflection, sound insulation, measurement methods and uncertainty, subjective evaluation of sound insulation
- Showcasing best practices: examples of existing building elements and analysis of their performance based on general/ theoretical principles and most common mistakes in execution of construction works

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Describe the global sustainability challenges and health threats related to noise and vibrations in the built environment and how relevant quantities relate to the subjective evaluation of sound insulation
- Analyze the main concepts and estimate the relevant quantities related to sound and vibration in the built environment
- Analyze and predict the airborne and impact sound insulation of building elements (walls and floors), including flanking transmission and improvements by vibration isolators, and the consequences of practical implementations on the actual sound insulation

Explain how relevant building acoustics parameters are measured and what measurement uncertainties can be expected

P&PD learning objectives:

- Organize a report in such a way that all the required elements are in place and so structured that the reader can, with little effort, make sense of each element and place it within the context of the report as a whole
- Argue a case thoroughly by giving well-grounded and legitimate evidence for claims made.
- Present formulas and calculations clearly and efficiently
- Make explicit the link between the claim made and the calculation underpinning it

Building inspection for future-proofing

Course code	Course level	Offered by	Year	Quartile
7PB1B20	Deepening	BPS	2	Q1

SHORT DESCRIPTION

In this course students will uncover the potential for future-proof buildings by examining existing spaces. Recognizing the crucial role of indoor environmental quality in spaces like schools and offices, we go on-site, measuring and analyzing the factors influencing that quality. You will transform data gathered into actionable insights, identifying key areas for improvement and paving the way for future redevelopment.

CONCEPTS

- Research (verb)
- Indoor Environmental Quality (IEQ)
- Energy demand in buildings
- Building inspection
- On-site measurements
- Data analysis
- Optimisation measures
- Reporting

LEARNING OBJECTIVES

At the end of this course the student is able to:

Academic attitude

- Search for (state of the art and properly scientific) information in the library and on the internet
- Analyse the information and give arguments for its scientific or scholarly cogency either being able to describe its provenance or to argue its claims.

Oral Presentation

- Speak clearly using the correct technical jargon in the correct context and correct way.
- Demonstrate that the presentation is professionally prepared. This becomes visible in the care with which all details are taken account of, everything is ready and working well before the start of the presentation.

Writing an article, essay, or report

- Organize the report in such a way that all the required elements are in place and so structured that the reader can, with little effort, make sense of each element and place it within the context of the project as a whole.
- Argue a case thoroughly by giving well-grounded and legitimate reasons/evidence for every decision/claim made.

Visualising, Drawing & modelling

- Make models with care and accurately, give reasons why the model was made the way it is.

Collaborating

- Work with others towards a common goal for a set period

Adaptability

- Anticipate changes and take, describe, and argue decisions while dealing with uncertainty, ambiguity, and risk.

Energy transition

- Describe the impacts and the implications of the challenges regarding buildings

Building Performance

Course code	Course level	Offered by	Year	Quartile
7B0B30	Deepening	BPS	3	Q1

SHORT DESCRIPTION

This course introduces students to building performance assessment (with a focus on energy and indoor environmental quality) during the (pre)design and operational phase of buildings. The course provides students with the conceptual knowledge to assess the performance of buildings in the (pre)design and operational phase using a variety of tools (e.g. sensors, data loggers and building performance simulation tools) and methods (e.g. measurement and simulation).

CONCEPTS

- Building Performance
- Performance Based Design
- Healthy Living Environment
- Thermal Comfort
- Heat Balance
- Building Energy Modeling
- Building Performance Simulation

LEARNING OBJECTIVES

Students will be able to:

- Apply the performance based approach to improve building performance and they will be able to value the concepts, assumptions and limitations that are related to the methods currently used in the performance based approach
- Utilize a state-of-the-art building performance simulation tool on a basic level to analyze the performance of a building design and to suggest design improvements
- Analyze building measurement data in order to assess building performance

Building Services

Course code	Course level	Offered by	Year	Quartile
7B1B30	Advanced	BPS	3	Q2

SHORT DESCRIPTION

The need to design near-Zero Energy Buildings, makes us strive towards an optimal synergy between building services, the building physics behavior and the function of the building in order to create a healthy and comfortable indoor environment for the occupants that is as efficient as possible in its use of resources. To achieve this, students are trained in a methodological system design approach, and learn how to design and engineer a climate system integrally, focusing on air handling systems and air distribution systems, also considering fire safety.

CONCEPTS

- Heating, cooling and ventilation
- Methodological system design
- Climate engineering
- Psychrometry
- Air distribution
- Thermal comfort
- Fire safety

LEARNING OBJECTIVES

At the end of the course students will be able to:

- Explain different systems and their applicability for heating, cooling, ventilation and air-conditioning
- Generate different building services design concepts, evaluate these and select the best for a particular building
- Discuss the underlying motivation for a selected specific building services concept
- Calculate the sensible heat load, latent heat load and energy balance of the human body
- Use the h-x diagram (psychrometric chart) based on the ideal gas law and conduct basic calculations with it
- Understand the basic air handling processes and draw these in the h-x diagram
- Use Bernoulli's law and the nomogram for the basic engineering of air distribution systems
- Explain the fire risks and fire safety measures for buildings and conduct basic calculations

Climate-responsive Building Design

Course code	Course level	Offered by	Year	Quartile
7PB4B20	Deepening	BPS	2	Q4

SHORT DESCRIPTION

In the light of climate change and its impact on the weather, conventional design practices may no longer work without compromising the building's energy efficiency and indoor environment. The need to design buildings that adapt to local conditions is therefore a must for future-proof buildings. As part of this project, you will therefore design a climate-responsive building and apply your acquired knowledge in a different context.

CONCEPTS

- Design (verb)
- Research (verb)
- Energy neutrality
- Climate change
- Materials

LEARNING OBJECTIVES

At the end of this course the student is able to:

- Analyze weather conditions and propose design solutions in response to this information
- Apply aquired knowledge in a different context

Personal & Professional Development (P&PD) learning objectives:

- Systems Thinking: Demonstrate awarness through description/ application that problems or solutions are part of a greater system and can identify and indicate the interrelations between individual contribuitions and their boundaries
- Analysing a point of view as a whole by differentiating into its constituent parts and showing how they relate to each other and describe how each part performs its specific role in that whole
- Justify conclusions to others orally, in writing and/or visually

Materialization of facades and roofs

Course code	Course level	Offered by	Year	Quartile
7EB2B20	Advanced	BPS	3	Q3

SHORT DESCRIPTION

This course aims at giving information to students about new trends and developments of materials in buildings, as well as their applications, and industrialization. The students have the opportunity to learn this by having lectures focusing on how the materials are made, used, and last over time, as well as guest lectures with several speakers from the building sector, giving more insight about this field. 2 small projects are also done to highlight specific design aspects of materialization in Eindhoven.

CONCEPTS

- Physical properties
- Water transfer in BM Thermal properties
- Timber hygroscopic properties
- Timber outdoor
- Lime and limestone
- Concrete manufacture
- Cement chemistry
- Cement replacement
- Aggregates Additives
- Applications
- Concrete structure
- Mortar and joints
- Lime application
- Stone and rocks Cladding systems
- Façade in blockwork
- Façade in timber
- Window frames in timber
- Metals (Ferrous Non Ferrous)
- Metal coatings
- Plastics and plastic frames
- Glass & glazing
- Material choice for glazing
- Physical aspects of glazing
- Curtain walls
- Visual concrete
- Fair-faced concrete
- Profiles and finish
- 3D printed concrete
- Concrete fouling
- Self-cleaning concrete
- Air-purifying concrete
- Durability definition
- Degradation factors

- Timber degradation
- Fickian diffusion (in timber)
- Durability of metals
- Ferrous/non-ferrous metals
- Corrosion theory Durability of plastic
- Coatings
- Chemical damage
- Thermo-mechanical damage
- Run-off
- Environmental degradation
- Fire damage
- Re-bar corrosion in concrete
- Carbonation
- Ceramic degradation
- Glazing degradation

LEARNING OBJECTIVES

After finishing this course the student is able:

- To name and/or draw the most common roofing and roof structures, as well as the materials from which they are constructed
- To analyze the important physical and materials-based design principles of facades and roofs
- Having knowledge for finding alternatives for these principles and structures, from traditional to innovative, and to sustainable-ecological
- Naming /analyzing regular and specific physical performances of façade - and roofing structures
- Naming /analyzing possible risks of architectural implementation of facades and roofs, depending on a design and a materials choice
- To describe the main (building) physical consequences of the relevant degradation factors (microclimate circumstances) for long term functioning of facades and roofs.
- Doing an adequate choice of materials for facades and roofs
- Having insight into why and how an identity of buildings wil be determined by the choice of materials of the façades mainly, and how it is confirmed by research

Physics of light and lighting design

Course code	Course level	Offered by	Year	Quartile
7EB1B20	Deepening	BPS	2	Q2

SHORT DESCRIPTION

The aim of this course is to provide students with the necessary knowledge and skills, to make a lighting design for indoor applications. The relevant knowledge will be provided by lectures accompanied by workshops. - Topics are light sources, luminaires, lighting control systems, light measurements and design tools. After finishing this course, students can register themselves for the accredited title of European Lighting Expert (https://europeanlightingexpert.org/en/home/)

CONCEPTS

- Lighting requirements
- Lighting design
- Light sources like LED, Incandescent, and Fluorescent
- Lighting control systems (like Dali)
- Light measurements (how to design a measurement plan and conduct measurements accordingly)
- Lighting simulation tools (Like Dialux)

LEARNING OBJECTIVES

At the end of the course, students will be able to demonstrate they have gained the necessary knowledge and skills for making an electric lighting design for a given space.

In addition, the following elements are needed to achieve the above:

- Describing the basics of light (Photometry and Colorimetry)
- Describing the different types of light sources and applying this best light source for a specific lighting design
- Describing and applying the different technologies for making electric lighting
- Describing and applying technologies for controlling electric light sources
- Describing and applying methods to predict and assess an existing lighting situation
- Describing and applying light simulation tools for making a lighting design

Regenerative Building Design

Course code	Course level	Offered by	Year	Quartile
7PB3B20	Deepening	BPS	2	Q3

SHORT DESCRIPTION

Regenerative design views buildings as part of a lager living system that helps to restore the natural resources they interact with, e.g. by generating energy on-site and sharing overproduction with the surroundings, designing non-polluting buildings, selecting materials with low environmental impact and compensating their embodied energy. With this in mind, you design, optimize and verify a regenerative and climate-neutral building applying an iterative design approach.

CONCEPTS

- Design (verb)
- Research (verb)
- Iterative Design Approach
- Advanced Calculations or Simulation Tools
- Operational Energy
- Energy Generation
- Embodied Energy
- Climate Neutrality

LEARNING OBJECTIVES

At the end of this course the student is able to:

- Demonstrate the application of the concept of climate neutrality in the performance of research or design
- Design, verify and optimize a building to an ambitious standard using an iterative design approach

Personal & Professional Development (P&PD) learning objectives:

- Design posters and slides in such a way that they can be considered as effective vehicles of relevant information leaving out non-relevant information. If challenged the student can describe and argue the relevance of all information on the poster/slide
- Make explicit the link between the claim made and the calculation under pinning it

Room acoustics

Course code	Course level	Offered by	Year	Quartile
7EB3B20	Introductory	BPS	3	Q4

SHORT DESCRIPTION

Every space should support the activities within that space with good acoustics, be it a lecture room, a meeting room, a living room or a canteen. The course is about sound in spaces, and is related to the question of how to design spaces such that they best support the usage of the space from an acoustical point of view. The course provides knowledge and skills via lectures and a room acoustics design assignment in which students use measurement and simulation tools.

CONCEPTS

- Impulse Response
- Auralization
- Convolution
- Transfer Function
- Impedance
- Room Acoustic Parameters
- Spectrum
- Sound Pressure Level
- Soundscape
- Improving Speech Transmission
- Speech privacy
- Enhancing Music Transmission

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Describe the importance of room acoustics in relation to health, comfort and function
- Describe the room acoustics quality of a space using the correct technical vocabulary
- Analyze room acoustic and acoustic material quantities
- Design potential improvements of the acoustics using calculation tools

P&PD learning objectives:

- Oral presentation: demonstrate that the presentation is professionally prepared
- Oral presentation: speak clearly using the correct technical jargon in the correct context and correct way
- Communication: describe results, methods, and processes with the correct terminology used in the correct way
- Calulating: make explicit the link between the claim made and the calculation underpinning it
- Planning and organizing: organize their own activities or activities within a group, so that results are achieved within a predetermined time with the available resources

Sustainable Retrofit

Course code	Course level	Offered by	Year	Quartile
7PB2B20	Deepening	BPS	2	Q2

SHORT DESCRIPTION

Starting from the definition of an ambitious program of requirements, this project will concern the transformation of an existing building with a focus on indoor environmental quality in relation to energy demand. The project zooms in at the room level while considering improvements to the building envelope and building systems. The project will use a performance-based design approach that considers engineering calculations for several design variations to reach a final solution that meets all criteria.

CONCEPTS

- (Re-) design (verb)
- Research (verb)
- Air quality
- Thermal comfort
- Building envelope
- Multi-criteria analysis
- Energy analysis

LEARNING OBJECTIVES

At the end of this course the student is able to:

- Develop a programme of requirements for multiple bps aspects by referring to relevant (literature) sources
- Analyse possible technical solutions in response to this por and synthesize multiple solutions in a coherent spatial concept
- Use multi-criteria analysis to choose among competing design variants
- Evaluate the performance of multiple design variants in terms of indoor environment and energy demand and use this information to optimize the design concept

Personal & professional development (P&PD) learning objectives:

- Organize her own activities or activities so that results are achieved within a predetermined time with the available resources
- Take and argue a decision taken autonomously by being open to the criticism and advice of others
- Reflect on planning and formulate lessons learned

Urban Physics

Course code	Course level	Offered by	Year	Quartile
7B0B20	Introductory	BPS	2	Q3

SHORT DESCRIPTION

Urban Physics is the science and engineering of physical processes in urban areas. It refers to the transfer of heat and mass in the outdoor and indoor urban environment through its interaction with humans, fauna, flora and materials. Urban physics is a rapidly increasing focus area as it is key to understanding and addressing the grand societal challenges of climate change, energy, health, security, transport and aging.

CONCEPTS

- Wind Flow
- Wind Comfort
- Heat Island Effect
- Heat Stress
- Noise Mapping
- Acoustics
- Noise Control
- Healthy Urban Environments

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Describe urban physics processes such as wind, air pollution, heat stress, the urban heat island effect and acoustics
- Argue on how to take into account urban physics processes and related consequences in the design of buildings and cities
- Analyze wind discomfort problems in urban environments and to develop potential solutions to these problems
- Enumerate the aspects that influence the urban sound environment, by using acoustic expressions
- Analyze urban sound environments of low quality, as well as to develop quantitative solutions
- Perform calculations of the sound level due to road traffic noise for simple urban situations

P&PD learning objectives

- Oral presentation: Demonstrate that the presentation is professionally prepared
- Communication: describe results, methods, and processes with the correct terminology used in the correct way
- Writing a report: organize the report/essay in such a way that all the required elements are in place and so structured that the reader can, with little effort, make sense of each element and place it within the context of the project as a whole
- Planning and organizing: organize her own activities or activities within a group, so that results are achieved within a predetermined time with the available resources

Healthful environments:
light, wellbeing and the biological clock

Course code	Course level	Offered by	Year	Quartile
0HVL10	Introductory	BPS by IE&IS	2	Q3

SHORT DESCRIPTION

Do our everyday environments affect our mental health? This course explains two important pathways of physical contexts towards mental health: stress and our biological clock. We will discuss both negative consequences and the potential of physical contexts to positively contribute to health and wellbeing. Lighting is an important component in these deliberations, as it directly relates to all relevant mechanisms and concepts above. In a case-based project you will learn to combine these various perspectives.

CONCEPTS

- Physical and mental health
- Wellbeingstress
- Stress
- Circadian rhythms
- Resilience, recovery, relaxation/restoration, and healthy sleep
- Light

LEARNING OBJECTIVES

After the course the student is able to:

- Describe the concepts of mental wellbeing, mental health, stress, stressors, circadian rhythms, and visual and non-visual effects of light
- Explain how environmental features contribute to mental health via stress-related mechanisms
- Explain how light features contribute to health and sleep via circadian mechanisms
- Explore these concepts in the context of a specific case
- Apply these concepts in formulating a justified direction for a solution based on a case description

Matrices and Differential Equations

Course code	Course level	Offered by	Year	Quartile
2DBA0	Introductory	BPS by M&MC		Q2

SHORT DESCRIPTION

The course consists of three main topics: complex numbers, matrices and differential equations.

1. Complex numbers: basic operations (sum, product, division), modulus, polar form, powers, Euler's formula.
2. Matrices: basic operations (sum, product), determinant, trace, inverse matrix, eigenvalues and eigenvectors, matrix diagonalization, linear systems of equations
3. Differential equations: first order differential equations with variable coefficients, second order differential equations with constant coefficients, linear systems of differential equations.

CONCEPTS

LEARNING OBJECTIVES

In this course students get acquainted with matrices and their properties as well as techniques to solve first and second order differential equations. The interplay between matrices and differential equations is also treated in order to solve systems of differential equations.

Bachelor End Project SED

Course code	Course level	Offered by	Year	Quartile
7S2B30	Advanced	SED	3	Q3&Q4

SHORT DESCRIPTION

This course is the bachelor end project in the track Structural Engineering and Design, and is an individual final piece of the Bachelor's program. During the BEP you show that you are able to execute a design a/o research project, based on requirements and self-developed insights. The level of the end project reflects the learning outcomes of the BSc AUBS.

For students preparing for the Graduate School Structural Design program, this course is strongly advised.

CONCEPTS

- Structural Optimization
- Structural Schematization And Calculation
- Research (Verb)
- Design (Verb)
- Formulate Research Questions To Design Project
- Building Details
- Project-Based Work
- Advanced Calculations Or Simulation Tools
- Optimization Strategies
- Reporting

LEARNING OBJECTIVES

Upon successful completion of Bachelor End Project, students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a research and design project within defined timelines under limited supervision

Product:

- Design a feasible structure for a highly complex building and convert the designed structure into mechanical schemes
- Dimension a complex structure and assess the designed structural elements at the requirements for structural safety and usability
- Use a 3D structural analysis software program such as SCIA or GSA and, meaning the ability to effectively control, analyse and apply the import and export of this program
- Clearly and concisely, present research/design outcomes in written, visual (drawings, model) or oral form

Combined project Structural & Architectural Design 1

Course code	Course level	Offered by	Year	Quartile
7PS1B21	Deepening	SED	2	Q1

SHORT DESCRIPTION

The combined project Structural & Architectural Design 1 in the first quartile of the second year focuses on structural design and its relationship with architecture. What is the connection between structural form, structural performances, and architectural design? The project aims to give more insight into the basic concepts of structural design in relation to architectural design. In this project, a simple building with a large span is designed, in which the emphasis is on meeting people and physical activity.

CONCEPTS

- Program of requirements
- Context
- Space
- Architectural Expression
- Structural Design
- Structural Element
- Tectonics
- Material Properties
- Grids
- Stability
- Force Distribution
- Dimensioning (rules of thumb)

LEARNING OBJECTIVES

Upon successful completion of Combined project Structural & Architectural Design 1, students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making.
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a limited research and design project within defined timelines
- Actively participate in a group with the goal of learning

Product:

- Create and translate an own set of requirements into an architectural design for a building using the basic AUDE concepts: program of requirements, context, space, architectural expression, materials, and building envelope
- Design a feasible structure for a building using the basic SED concepts: structural elements, material properties, grids, stability, load and force distribution, and dimensioning (rules of thumb, references)
- Understand the relationship between architectural design and structural design
- Clearly and concisely present research/ design outcomes in written, visual (drawings, model) or oral form

Combined project Structural & Architectural Design 2

Course code	Course level	Offered by	Year	Quartile
7PS2B21	Deepening	SED	2	Q2

SHORT DESCRIPTION

The combined project Structural & Architectural Design 2 in the second quartile of the second year focuses on structural design and its relationship with architecture. What is the connection between structural form, structural performance, and architectural design? The project aims to give more insight into the concepts of structural design in relation to architectural design. In this project, a medium-sized building willbe designed, in which the emphasis will be on mental reflection, such as a chapel or a meditation space.

CONCEPTS

- Program of requirements
- Context,
- Space
- Architectural Expression
- Tectonics
- Sequences
- Proportion
- Structural Design
- Structural Elements
- Material Properties
- Grids
- Stability
- Force distribution
- Permanent loads
- Live loads
- Load Combinations
- Dimensioning
- Strength
- Stiffness

LEARNING OBJECTIVES

Upon successful completion of Combined project Structural & Architectural Design 2, students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making.
- Reflect on their design process.
- Reflect on their learning process.
- Effectively plan and execute a limited research and design project within defined timelines.
- Actively participate in a group with the goal of learning.

Product:

- Create and translate an own set of requirements into an architectural design for a building using the AUDE concepts: program of requirements, context, space, architectural expression, materials and building envelope.
- Organize the configuration and sequence of spaces.
- Define the form and proportions of spaces and their desired atmosphere/quality.
- Integrate architectural design and structural design
- Design a feasible structure for a building using the SED concepts: structural elements, material properties, grids, and stability.
- Schematize the designed structure into mechanical schemes in a 2-D framework.
- Determine loads (permanent and variable) and set the relevant permanent and variable load cases and combinations.
- Use a simple 2-D framework program such as Technosoft and, meaning the ability to effectively control, analyze and apply the import and export of this program.
- Dimension a structure and assess the designed basic structural elements at the requirements for structural safety and usability.
- Clearly and concisely, present research/ design outcomes in written, visual (drawings, model) or oral form

Combined project Structural & Architectural Design 3

Course code	Course level	Offered by	Year	Quartile
7PS3B21	Deepening	SED	2	Q3

SHORT DESCRIPTION

The Combined project Structural & Architectural Design 3 in the third quartile of the second year focuses on structural design and its relationship with architecture. What is the connection between structural form, structural performances, and architectural design? The project aims to give more insight into the concepts of structural design in relation to architectural design. In this project, a complex demountable building is designed, in which the emphasis is on housing and leisure activities.

CONCEPTS

- Program Of Requirements
- Context
- Space
- Architectural Expression
- Tectonics
- Sequences
- Proportion
- Details
- Building Technology
- Structural Design
- Structural Elements
- Material Properties
- Grids
- Stability
- Force Distribution
- Permanent Loads
- Live Loads
- Load Combinations
- Dimensioning
- Strength
- Stiffness

LEARNING OBJECTIVES

Upon successful completion of Combined project Structural & Architectural Design 2, students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a limited research and design project within defined timelines
- Actively participate in a group with the goal of learning

Product:

- Create and translate an own set of requirements into an architectural design for a complex building using the AUDE concepts: program of requirements, context, space, architectural expression, materials and building envelope
- Organize private, semi-public, and public spaces within a building
- Organize the configuration and sequence of spaces
- Define the form and proportions of spaces and their desired atmosphere/quality
- Integrate architectural design and structural design
- Design a feasible structure for a building using the SED concepts: structural elements, material properties, grids, and stability
- Schematize the designed structure into mechanical schemes in a 2-D framework and convert this into structural details
- Determine permanent and variable (live and wind) loads and set the relevant permanent and variable load cases and combinations
- Use a simple 2-D framework program such as Technosoft and, meaning the ability to effectively control, analyze and apply the import and export of this program
- Dimension a structure and assess the designed basic structural elements at the requirements for structural safety and usability
- Compose facade and roof details considering grid dimensions, demountability and manufacturability
- Clearly and concisely, present research/ design outcomes in written, visual (drawings, model) or oral form

Combined project Structural & Architectural Design 4

Course code	Course level	Offered by	Year	Quartile
7PS4B21	Deepening	SED	2	Q4

SHORT DESCRIPTION

The combined project Structural and Architectural Design 4 in the fourth quartile of the second year focuses on structural design and its relationship with architecture. What is the connection between structural form, structural performances, and architectural design? The project aims to give more insight into the concepts of structural design in relation to architectural design. In this project, a complex building with a large span is designed, in which the emphasis is on community activities in relationship with public and private access.

CONCEPTS

- Program Of Requirements
- Context
- Space
- Architectural Expression
- Tectonics
- Sequences
- Proportion
- Details
- Costruction Technology
- Structural Design
- Structural Elements
- Material Properties
- Grids
- Stability
- Force Distribution
- Permanent Loads
- Live Loads
- Load Combinations
- Dimensioning
- Strength
- Stiffness

LEARNING OBJECTIVES

Upon successful completion of Combined project Structural & Architectural Design 2, students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a limited research and design project within defined timelines
- Actively participate in a group with the goal of learning

Product:

- Create and translate an own set of requirements into an architectural design for a complex building using the AUDE concepts: program of requirements, context, space, architectural expression, materials and building envelope
- Organize private, semi-public, and public spaces within a building
- Organize the configuration and sequence of spaces
- Define the form and proportions of spaces and their desired atmosphere/quality
- Integrate architectural design and structural design
- Design a feasible structure for a building using the SED concepts: structural elements, material properties, grids, and stability
- Schematize the designed structure into mechanical schemes in a 2-D framework and convert this into structural details
- Determine permanent and variable (live and wind) loads and set the relevant permanent and variable load cases and combinations
- Use a simple 2-D framework program such as Technosoft and, meaning the ability to effectively control, analyze and apply the import and export of this program
- Dimension a structure and assess the designed basic structural elements at the requirements for structural safety and usability
- Identify the relationships and potential problems of a design with the structural, building technological and construction technological aspects of the design and generate global solutions
- Select and elaborate an appropriate construction method and sequence at the complete building scale
- Clearly and concisely, present research/design outcomes in written, visual (drawings, model) or oral form.

Concrete and Masonry Structures

Course code	Course level	Offered by	Year	Quartile
7S0B30	Advanced	SED	3	Q2

SHORT DESCRIPTION

Concrete and masonry are commonly used as structural materials throughout the world. During this course, students will familiarize themselves with basic structural design for these materials. The application of Eurocode 2 (concrete) and Eurocode 6 (masonry), European standards for design of these structures, is introduced. The similarities between concrete and masonry will be highlighted, but it should be noted that structures created with these materials each has its own characteristics. In this course. In general they are therefore treated separately.

CONCEPTS

Concrete Structures:

- Introduction of relevant material properties
- Moment resistance of beams and slabs
- Shear resistance of a cross section with and without shear reinforcement
- Anchorage and bond of reinforcement
- Torsion resistance of a cross section
- Punching shear resistance of flat slabs
- Combined axial force and moment resistance for walls and columns
- Design of slabs, including structural drawings
- Sustainment and sustainable design of concrete structures
- Control of crack width and deflection

Masonry Structures:

- Introduction of material properties of units, mortar and masonry and the experimental determination of these properties
- Design of vertical load bearing masonry walls
- Design principles and overall stability: load distribution stiffness of shear walls
- Lateral loading on masonry walls
- Introduction of a design example of a masonry structure of an apartment building
- Design of masonry facades

LEARNING OBJECTIVES

At the end of the course a student is able to:

Concrete:

- Design a basic reinforced concrete structure consisting of beams, plates, walls and columns according to Eurocode 2
- Understand the behaviour of both concrete and reinforcement steel
- Verify the resistance against internal forces such as moments, shear forces and torsion
- Verify the cracking in and deflection of the structure

Masonry:

- Design a basic unreinforced masonry structure according to Eurocode 6
- Understand the behaviour of masonry and its components like bricks and mortar
- Verify the resistance of masonry walls against vertical and horizontal loading
- Verify the stability of the structure consisting of masonry walls and floor diaphragms

Digital Structures

Course code	Course level	Offered by	Year	Quartile
7ES1B20	Introductory	SED	3	Q3

SHORT DESCRIPTION

In this course, students will explore digital design and manufacturing technologies for applications in the field of structural engineering and design. Students learn about the potential and challenges of parametric modelling, structural optimization, robots for construction and large-scale additive manufacturing, through hands-on exercise(s) supported by (guest) lectures, tutorials and workshops.

CONCEPTS

- Parametric Modelling
- Structural Optimization
- Robotic Manufacturing
- Digital Fabrication
- 3d Printing

LEARNING OBJECTIVES

After this course, students will be able to:

- Describe the role of digital design tools for the field of structural engineering & design, including parametric modelling, structural optimization, and design exploration
- Recognize various optimization algorithms and strategies, to create safe structural designs with minimized environmental impact
- Discuss robotic manufacturing strategies and their fabrication constraints, for various structural system and materials
- Apply parametric modelling tools to explore structural design in a digital manner
- Demonstrate the use of robotic manufacturing to create simple structural designs in an automated manner

Dimensioning of structures

Course code	Course level	Offered by	Year	Quartile
7S0B20	Deepening	SED	2	Q1

SHORT DESCRIPTION

This course guides the student through the dimensioning and engineering of structural elements for a building design with its structural system. It will focus on the three most common structural materials: steel, concrete, and timber. Instructions (both in class and by video) are given to practice the dimensioning process and related applied mechanics. The acquisition of these competencies will then allow students to understand the presentation of inspiring works of architecture and their structural systems, which visualise and demonstrate the principles learned. On top of this, the course will relate these aspects to special concerns such as sustainability and fire safety.

CONCEPTS

- The determination of normal stress and strain in elements due to normal force
- Material properties of steel, concrete, and timber, their relationship with normal stress and strain, their relevance for the dimensioning of structural elements, and their relationship with architecture
- The determination of normal stress and strain in elements due to bending moment, first and second moment of area, shear stress and strain in elements due to shear force and torsion
- The dimensioning of structural elements in the three most used structural materials: steel, concrete, and timber. As a function of material properties, normal and shear stress and strain, and design code requirements are treated
- The determination of deformations in truss structures due to normal forces, and in beam structures due to bending moment and torsion
- The relationship between the dimensioning of elements and the topology of the structural system, the relationship between the building's architecture and structural system, and the concurrent design of inspiring and sustainable structural systems in steel, concrete, and timber
- Special subjects

LEARNING OBJECTIVES

At the end of this course students will be able to:

- Predict deformations and stresses in a mechanics scheme due to normal force, bending, shear, and torsion, based on the force distribution in statically determined structures (as learned in the course Statics of Structures)
- Dimension structural elements, i.e. design column or beam cross-sections for given deformations and stresses within the structure, based on relevant material properties
- Engineer (i.e. provide dimensions and further specifications of) structural elements, such as columns, beams, walls, and floors, constructed in steel, concrete, and timber
- Understand the interdisciplinary relationship between an architectural building design, structural system topologies, and the dimensioning of structural elements
- Present and manipulate formulas and calculations clearly and correctly, and the underlying principles of the formulas are understood (P&PD Calculating, level 3)
- Define and describe the sustainability aspects of structural systems in steel, concrete, timber, and to recognise these aspects in existing buildings and structural systems (P&PD Sustainability, level 1)
- Understand the codes for materials, loads, boundary conditions, and structural elements in a technical drawing (P&PD Visualising, Drawing & Modelling, level 1)
- Search for (state of the art and properly scientific) information in the library, on the internet, and in real life on buildings and structural systems in steel, concrete, and timber, and to interpret the interdisciplinary relationship between an architectural building design, structural system topologies, and the dimensioning of structural elements (P&PD Academic attitude, level 2)
- Analyse a problem in dimensioning by differentiating it into its constituent parts, showing how they relate to each other, and describing how each part performs its specific role (P&PD Argumentation, level 3)

Experimental research of structures and materials

Course code	Course level	Offered by	Year	Quartile
7ES2B20	Advanced	SED by M&MC	3	Q4

SHORT DESCRIPTION

This course shows, in general, how structural material properties are assessed by experiments, what the prerequisites are and how the results are used in structural design calculations.

CONCEPTS

- Material's properties (physical, mechanical,chemical...)
- Material's characterization
- Material's application (civil engineering andarchitecture)
- Sustainability and circularity
- Experimental research

LEARNING OBJECTIVES

After completing this course, the student will be able to:

- Conduct experiments on structures and parts thereof, with as smallest component tests on the materials themselves, requires specific knowledge of measurement techniques, statistics and mechanics. To assess whether existing structures still have sufficient load-bearing capacity requires non-destructive testing. When loads have a dynamic character (earth quakes) measuring frequency and modelling become more prominent
- Apply standard scientific methodology to plan, design, conduct and report a range of civil engineering experiments
- Develop the ability to apply these principles in the solution of simple practical problems
- Gain an understanding of how physical measurements and systematic errors can affect results and the challenges of gaining precise and accurate empirical data
- Interpret and use relevant mathematical notation and terminology
- Conduct experiments, subsequently analyse the data and report it in a clear and structured way

Foundations of Data Analytics

Course code	Course level	Offered by	Year	Quartile
2IAB1	Introductory	M&MC	2	Q2

SHORT DESCRIPTION

Urban planning, development and management are increasingly becoming data driven. Data analytics is essential for understanding urban dynamics and planning sustainable communities. It helps with analyzing trends, patterns, and user behaviors, and provides evidence to support design decisions.

This course focuses on techniques for analyzing large amounts of data in an efficient, reliable, and consistent way. Students get understanding of the data life cycle and develop skills for structuring their solutions of practical problems along the phases of this cycle. They develop skills in understanding, interpreting, and documenting data and information in the context of realistic scenarios. Students learn to implement their solutions for data analytics problems in a programming language (Python), and apply a structured and systematic approach to data processing.

In the two challenges of this course students will formulate and answer societally relevant questions in a data-driven way.

CONCEPTS

- Data visualization
- Data mining (clustering, decision trees, association rules, regression, quality metrics)
- Data organization (databases, data models, queries)
- Data cleaning
- Data transformation and aggregation
- Statistical analysis
- Research methods in data analytics
- Programming (Python)

LEARNING OBJECTIVES

General learning goals

- Use basic statistical concepts and techniques and perform appropriate statistical tests in the context of real life problems
- Choose and apply suitable visualization techniques
- Analyze and model data using linear regression, clustering, decision tree mining and association rules learning
- Read and make simple database schemes and simple queries to a database
- Clean data, choose and apply data transformations, data reduction, and data discretization
- Understand, interpret, and document data and information in the context of realistic scenarios, structure open problems along the phases of the data life cycle, formulate hypotheses, incorporate ethical considerations and reflect on analysis trengths and limitations
- Use tools for implementing data engineering tasks (Python with Jupiter Notebooks) in a structured way
- Choose and communicate interesting findings in the language understandable for their end user (visually or textually).

Project 1

STRUCTURAL ENGINEERING & DESIGN

Course code	Course level	Offered by	Year	Quartile
7PS1B20	Deepening	SED	2	Q1

SHORT DESCRIPTION

The second-year Project 1 - Structural Engineering and Design is focused on acquiring and expanding basic knowledge and skills in the field of Structural Engineering and Design. In this project, students design a building with a high complexity such as a multifunctional building, train station or bus station, with an emphasis on functionality, design, and structure at the scale of the building.

CONCEPTS

- Program of requirements
- Sequences
- Space
- Structural Design
- Structural Elements
- Material Properties
- Grids
- Stability
- Force Distribution
- Dimensioning (rules of thumb)

LEARNING OBJECTIVES

Upon successful completion students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a limited research and design project within defined timelines
- Actively participate in a group with the goal of learning

Product:

- Create and translate an own set of requirements into an architectural design for a building with high complexity
- Design a feasible structure for a highly complex building using the basic SED concepts: structural elements, material properties, grids, stability, load and force distribution, and dimensioning (rules of thumb, references)
- Understand the relationship between architectural design and structural design
- Identify the relationships and potential problems in the structural design in relation to the building technology and construction technology
- Clearly and concisely present research/design outcomes in written, visual (drawings, model) or oral form

Project 2

STRUCTURAL

ENGINEERING & CONSTRUCTION TECHNOLOGY

Course code	Course level	Offered by	Year	Quartile
7PS2B20	Deepening	SED	2	Q2

SHORT DESCRIPTION

The second-year Project 2 - Structural Design & Construction Technology focuses on acquiring and expanding basic knowledge and skills in the field of Structural Engineering and Design and Construction Technology. In this project, students dimension the structure designed in Project 1 - Structural Engineering and Design with an emphasis on the construction process of the full building.

CONCEPTS

- Structural Design
- Structural Elements
- Material Properties
- Grids
- Stability
- Force Distribution
- Permanent Loads
- Variable Loads (Live loads And Wind loads)
- Load Combinations
- Dimensioning (Technosoft)
- Strength
- Stiffness
- Construction technology

LEARNING OBJECTIVES

Upon successful completion students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a limited research and design project within defined timelines.
- Actively participate in a group with the goal of learning

Product:

- Design a feasible structure for a highly complex building at the building scale
- Schematize the designed structure into mechanical schemes in a 2-D framework
- Determine loads (permanent and variable) and set the relevant permanent and variable load cases and combinations
- Use a simple 2-D framework program such as Technosoft and, meaning the ability to effectively control, analyze and apply the import and export of this program
- Dimension a structure and assess the designed basic structural elements at the requirements for structural safety and usability
- Identify the relationships and potential problems of a design with the structural, building technological and construction technological aspects of the design and generate global solutions
- Select and elaborate an appropriate construction method and sequence at the complete building scale
- Clearly and concisely, present research/design outcomes in written, visual (drawings, model) or oral form

Project 3

STRUCTURAL ENGINEERING & BUILDING TECHNOLOGY

Course code	Course level	Offered by	Year	Quartile
7PS3B20	Deepening	SED	2	Q3

SHORT DESCRIPTION

The second-year Project 3 - Structural Engineering & Building Technology focuses on acquiring and expanding the students' knowledge and skills in the field of Structural Engineering, Design and Construction Technology. In this project, students concentrate on the advanced development of skills in designing and dimensioning the structure designed in Project 1 - Structural Engineering and Design and Project 2 - Structural Engineering & Construction Technology with an emphasis on the fields of Structural Design and Building Technology, explored at a more detailed scale.

CONCEPTS

- Structural Design
- Structural Elements
- Material Properties
- Grids
- Stability
- Force Distribution
- Permanent Loads
- Variable Loads (Live loads And Wind loads)
- Load Combinations
- Dimensioning (Technosoft)
- Strength
- Stiffness
- Structural Details
- Building Envelope Details (Building technology)

LEARNING OBJECTIVES

Upon successful completion students will be able to:

Process:

- Systematically approach a given problem by clearly defining the problem statement, setting goals, and thoughtfully evaluating alternative solutions, while providing explanations for decision-making
- Reflect on their design process
- Reflect on their learning process
- Effectively plan and execute a limited research and design project within defined timelines
- Actively participate in a group with the goal of learning

Product:

- Convert the mechanical scheme into feasible structural elements and details for a highly complex building
- Dimension structural details and assess the designed elements at the requirements for structural safety and usability
- Select and elaborate on an appropriate construction method on a detailed scale
- Compose facade and roof details using materials, systems, and products available on the market. This includes consideration grid dimensions, manufacturability, and execution order
- Develop integrated multi-perspective, considering structural engineering and design, construction technology and building technology
- Clearly and concisely, present research/design outcomes in written, visual (drawings, model) or oral form

Project 4

RESEARCH PROJECT IN STRUCTURAL DESIGN

Course code	Course level	Offered by	Year	Quartile
7PS4B20	Deepening	SED	2	Q4

SHORT DESCRIPTION

The goal of the course is to define and answer a research question that can be solved by a sensitivity study. This is done in the context of the analysis of the structural behavior of a truss structure. To answer the research question, the students will make use of a numerical model of the truss structure. The numerical model is formulated by adopting the matrix method, which will be explained in the first part of the project. To make sure that the numerical model is sound, the students are required to compare the results of the model against known theoretical solutions and experimental results. This process, also known as “validation of the model”, requires the identification of the limitations of the model to predict the experimental results, thus explaining the reasons. Therefore, the students will perform experimental, and analytical analyses of a truss to validate the numerical model. In this way, the students can answer the research question by making use of the numerical model, which allows for fast computation.

CONCEPTS

- Research question
- Sensitivity study
- Numerical models
- Matrix method
- Validation of models
- Experiments, analytical models

LEARNING OBJECTIVES

At the end of this course the student will be able to:

- Design a research question
- Generate a numerical model of the truss using the matrix method in Matlab
- Clarify steps leading either to model validation or model calibration
- Execute a sensitivity study to answer the research question
- Execute experiments in the laboratory
- Interpret the results obtained from theory, experiments, and models

Steel Structures and Applied Mechanics

Course code	Course level	Offered by	Year	Quartile
7S1B20	Advanced	SED	2	Q2

SHORT DESCRIPTION

This course focuses on Applied Mechanics and Steel Structures. Students acquire practical skills for steel structure design based on a robust understanding of applied mechanics, aligned with current standards.

CONCEPTS

- Theory of stresses: 2d and 3d stress states both analytically and graphically
- Stresses and deformations of inhomogeneous cross-sections due to normal forces, bending moments and shear forces
- Plastic cross-sectional resistance and collapse analysis: plastic material behavior and its implications for cross-sectional resistance, collapse analysis of beams and frames
- The resistance of steel cross-sections
- The design of welds and bolts
- Modelling and design of steel structures
- Buckling stability: flexural buckling stability of compression elements, buckling stresses, stability of elements under combined compression and bending
- Stability of steel columns (compression), beams (bending) and beam-columns (combined compression and bending

LEARNING OBJECTIVES

Having followed this course, students are able to:

- Calculate the principal stresses and principal directions departing from an initial stress state
- Calculate the stress state with respect to an arbitrary rotation angle
- Calculate the normal and shear stresses in structures with inhomogeneous cross-sections
- Determine the elastic critical buckling load and draw the corresponding buckling mode
- Calculate the plastic capacity of cross-sections (in pure bending and for a combined bending and normal force loading)
- Determine the collapse load of beams and frames based on plastic material behavior

Also, the student can:

- Apply the classification of cross-sections
- Demonstrate having knowledge of the background to the design rules for the resistance of welds, bolts, cross-sections and the stability of skeletal steel structures in relation to applied mechanics
- Calculate the resistance and stability of skeletal steel structure elements (columns, beams, beam-columns) by using the design rules
- Design and calculate the resistance of welded and bolted connections

Sustainable Design of Structures

Course code	Course level	Offered by	Year	Quartile
7ES0B20	advanced	SED	3	Q1

SHORT DESCRIPTION

In this course, students will explore basic structural concepts to design structures, different approaches for sustainable design, and possible strategies to transform a material-efficient structure into a complete eco-effective design.

CONCEPTS

- Buckling
- Equilibrium
- Bending
- Deflection
- Prestress
- Center of mass
- Torsion
- Shear
- Stress distribution
- Direct force path
- Circularity
- Renewable materials
- Durability
- Waste reduction
- Life-cycle analysis
- Embodied energy
- Global warming potential
- Material-efficient structures
- Eco-effective design
- Disassembly and reusability
- Bio-based materials

LEARNING OBJECTIVES

Upon completion of this course, the student is able to:

- Describe various strategies to achieve sustainability in relation to the life cycle of a structure
- Identify and explain different structural concepts and be able to use them to design building structures efficiently
- Calculate the carbon footprint impact of structural systems and materials
- Account for sustainability aspects in the early stage of the design of a structure
- Explain the advantages and limitations of bio-based materials in structural applications

Timber Structures and Applied Mechanics

Course code	Course level	Offered by	Year	Quartile
7S2B20	Advanced	SED	2	Q3

SHORT DESCRIPTION

This course is divided in two parts:

Timber Structures

The Timber structures part of the course is about the structural design of timber structures. It follows the principle from the first architectural design transformed into a real timber structure. The course is about understanding and learning to apply the properties and specific characteristics of timber in a structural design. Beside the origin of the natural material, and the orthrotropic material behavior also topics as sustainable forest management and durable detailling are subject of this course.

Applied Mechanics (Statically Indeterminate Structures)

The applied mechanics part of the course introduces the concepts of dimensional stability and static and kinematic determinacy, providing a basis for identify and classify statically indeterminate structures. Two solution methods for statically indeterminate structures are treated: the force method and the deformation method. The two methods will be compared to understand their respective advantages and disadvantages, and to be able to critically select the more appropriate method for solving specific statically indeterminate structures.

CONCEPTS

- Applied Mechanics:
  - Dimensional Stability
  - Static and Kinematic Determinacy, Force method for statically indeterminate structures, Deformation method for statically indeterminate structures
  - Timber Structures - deflection including creep + shear deflection
- Bending stress
- Shear stress
- Tension and compression
- Strength classes & orthotropic properties
- Material parameter (γM)
- Modification parameter (kmod)
- Buckling of columns
- Lateral torsional buckling (introduction)
- Shrink and swell
- Timber connections
- Moment resistant timber connections
- Structural concepts in timber

Timber Structures and Applied Mechanics

Course code	Course level	Offered by	Year	Quartile
7S2B20	Advanced	SED	2	Q3

LEARNING OBJECTIVES

At the end of this course, students will be able to:

Timber Structures

- Design and calculate basic timber structures
- Define and simplify timber structures in to a mechanical model in such a way that they are ready for structural calculations
- Understand the orthotropic material properties and how to use them in a calculation

Applied Mechanics

- Dimensional stability
- State the definition of dimensional stability of a body. Based on this definition, students will be able to classify a given structure as a dimensionally stable or a dimensionally unstable body. Student will be able to apply this concept for both two dimensional and three dimensional structures

Static and kinematic determinacy

- State the definition of static and kinematic determinacy of a body
- Based on this definition, students will be able to classify a given structure as kinematically eterminate/indeterminate and statically determinate/indeterminate
- In particular, in case of statically indeterminate structures, the student will be able to execute a determinacy analysis to calculate the degree of static indeterminacy. This concept will be applied for both two dimensional and three dimensional structures

Force method for statically indeterminate structures

- Summarize the steps of the force method
- Given a statically indeterminate structure, students will be able to use the force method to solve (i.e. calculate support and internal forces) the considered structure
- In particular, students will be able to apply the force method for both two dimensional and three dimensional structures

Deformation method for statically indeterminate structures

- Summarize the steps of the deformation method
- Given a statically indeterminate structure, students will be able to use the deformation method to solve the considered structure

Method comparison

- Compare the different features of the force and deformation method and the corresponding advantages/disadvantages
- Given a statically indeterminate structure, students will be able to critically judge which between the force or deformation methods is more appropriate to solve the specific structure considered

Bachelor End Project USRE

Course code	Course level	Offered by	Year	Quartile
7U2B30	Advanced	USRE	3	Q3&Q4

SHORT DESCRIPTION

Planners, designers and managers determine to an important extent how the built environment is shaped, where people reside, work and recreate. Good decision-making needs good information about the needs and preferences of people we build for. In this project, you will learn how to set-up a research, how to analyze the data in a statistically appropriate way, and draw conclusions.

CONCEPTS

- Residential satisfaction
- Energy use
- Green facilities
- Mobility
- Social interaction
- Literature
- Data base
- Data preparation
- Analysis
- Conceptual model
- Research instrument

LEARNING OBJECTIVES

Students learn the basics of how to set up and execute a quantitative research. At the end of this project the student is able to…

- Perform a literature study
- Formulate the research problem, the aim of the research, and the research questions
- Develop a conceptual model
- Design or describe the research instrument
- Analyse the data and interpret the results
- Critically evaluate your research
- Report your research

Design project Smart Mobility

Course code	Course level	Offered by	Year	Quartile
7EU4B20	Deepening	USRE	3	Q2

SHORT DESCRIPTION

Smart Mobility Design requires us to rethink mobility fundamentally by taking a systems approach. The future mobility is expected to integrate the mobility demand, logistics supply, and new ICT and transportation technologies. In this course, you work in teams to design and analyze a smart mobility concept/solution for the TU/e university campus, a neighboring district, or, at a larger scale, the Eindhoven city based on the knowledge obtained from the previous courses, including but not limited to those in the Smart Mobility Design package.

CONCEPTS

- Urban Mobility
- Autonomous Vehicles
- Mobility-As-A-Service
- Stakeholder Analysis
- Supply-And-Demand Mismatch
- Accessibility
- Congestion
- Social Inclusion
- Travel Satisfaction

LEARNING OBJECTIVES

Students who finish this course should be able to:

- Define and execute a project within a team
- Apply modeling techniques from the related course Mobility and logistics (7W3X0) or Mobility and Forecasting (7EU3B20) and other basic modeling courses
- Collect data or apply experimental techniques to support the problem definition
- Generate innovative ideas for freight or passenger mobility in a study area
- Apply engineering design principles to this problem
- Present the work in the form of a scientific report and a presentation

Digital Built Environment

Course code	Course level	Offered by	Year	Quartile
7EU1B20	Introductory	USRE	2	Q2

SHORT DESCRIPTION

What will smart buildings be like in the future? What will future cities look like? How can we create and interact with a digitally enhanced built environment? How can we increase the efficiency and productivity in Architecture, Engineering and Construction? Digital technologies and data hold the answer to questions like these.

Smart buildings, sensors, wearable devices, autonomous vehicles, robots, Digital Twins and Artificial Intelligence are already transforming the built environment from a static medium that merely hosts inhabitants to an intelligent medium that interacts with them and responds to their needs. This course will discuss how data generated throughout the life cycle of built assets and (emerging) digital technologies give an opportunity to develop advanced, technologically sound, and tailored engineering solutions to pressing challenges in the built environment (e.g., decarbonisation, energy transition, resource use, sustainability, efficiency, occupant health and well-being, etc.).

CONCEPTS

- Digitalisation
- Digital technologies
- Information systems
- Building Information Modelling
- City Information Modelling
- Information management
- Smart buildings
- Smart cities
- Digital Twins
- Emerging technologies
- Artificial Intelligence in the built environment

LEARNING OBJECTIVES

After successful completion of this course, students will be able to:

- Explain the role and impact of digitalisation and digital technologies on the built environment from the perspective of Buildings, Cities and Humans
- Identify the relevant data sources and types in every phase of the lifecycle of built assets, as well as the challenges they address
- Explain the intersection and interaction between Building Information Modelling and City Information Modelling
- Utilise fundamental Building Information Modelling and City Information Modelling techniques, data models and applications
- Develop a Building Information Model of a selected building in available software and understand what information can be modelled in support of the diverse stakeholders in the context of Architecture, Engineering and Construction
- Integrate simple Building- and City Information Models using available software
- Explain emerging technologies and their application in the built environment, as well as the opportunities they provide

Geographic modeling of built environment

Course code	Course level	Offered by	Year	Quartile
7EU6B30	Introductory	USRE	3	Q4

SHORT DESCRIPTION

This course deals with Geographical Information Systems (GIS) and GPS Data collection and analysis. This course is about theory, tools and techniques to handle geographic data using Geographic information systems (GIS) which allow for storing, representing, and manipulating geographic data. GIS offers tools for site selection, accessibility assessment, and spatial planning. Special attention will be paid to GPS data collection methods for mapping and analyzing data.

CONCEPTS

- Spatial Data Models
- Spatial Objects
- Spatial Data
- Spatial Data Management
- Spatial Data Analysis
- Thematic Maps

LEARNING OBJECTIVES

At the end of this course students are able to…

- Identify and describe spatial objects in 2D
- Interpret and create various geographical datasets according to gis standards
- Apply geographical information systems and related techniques such as site selection, overlay
- Analysis, and accessibility analysis
- Understand gps based data collection and analyses

Housing, RE & urban Economics

Course code	Course level	Offered by	Year	Quartile
7EU0B20	Deepening	USRE	2	Q1

SHORT DESCRIPTION

This course studies the land market and real estate market for housing, including demand, supply and prices. It introduces quantitative applied methods of analyzing housing demand and preferences. It deals with instruments and challenges in the development and management of residential real estate.

CONCEPTS

- Residential Real Estate
- Urban Economics
- Housing Demand and preferences

LEARNING OBJECTIVES

At the end of this course students are able to demonstrate understanding of..

- The land market and real estate market for housing, including demand, supply and prices
- The basic concepts and models from urban economics
- The quantitative applied methods of analyzing housing demand and preferences
- The regulations and policies on the real estate market
- Instruments and challenges in the development and management of residential real estate
- The strategies to improve the sustainability of the housing stock

In addition this course contributes to:

- Insight in various social and economic disciplines relevant for building engineering and architecture
- Broad basis for inter- and multi-disciplinary collaboration

Mobility and Forecasting

Course code	Course level	Offered by	Year	Quartile
7EU3B20	Deepening	USRE	3	Q1

SHORT DESCRIPTION

Urban mobility requires fundamental rethinking in light of recent developments in data-driven technology. This requires us to take a systematic approach for route- and mode-choice problems that integrates travel demand forecasting and transportation technologiy for policy making. In this course, you will learn the principles of modelling personal mobility and forecasting for travel choices. The insights aquired during this course are requisite for the course Design Project Smart Mobility.

CONCEPTS

- Activity Based Modelling
- Discrete Choice Analysis
- Supernetworks
- Model-Based Decison Making
- Impact Analysis
- Supply-And-Demand
- Willingness To Pay
- Forecasting
- Urban Tansport
- Transport Policy

LEARNING OBJECTIVES

Students who finish this course should be able to:

- Describe fundamental concepts in mobility, the mobility market, as well as how policy can impact mobility behavior
- Explain why behaviour analysis and decision making model are necessary in transportation, and how they are used in the Netherlands and internationally
- Use activity-based models to predict activity patterns and travel flows
- Use discrete choice modelling in travel demand forecasting and analyze model based results
- Apply the concept of supernetworks and graph representations of unimodal and multimodal transport systems

Project Green, healthy and social neighborhoods

Course code	Course level	Offered by	Year	Quartile
7PU2B20	Deepening	USRE	2	Q2

SHORT DESCRIPTION

This project is the second in the series of four offered in the SURE-track and focusses on the scale of the neighborhood and the theme of health. The neighborhood is the daily living environment for city dwellers and therefore very important for their health and wellbeing. Urban green can greatly contribute to the experience of neighborhoods as pleasant, good for health and encouraging social interaction. Moreover, urban green has a lot of potential regarding climate mitigation and adaptation (e.g. cooling and water storage). This project is about strategies for introducing urban green into neighborhoods and making proposals for concrete interventions to make a neighborhood benefit from urban greenery to improve health and wellbeing.

CONCEPTS

- Healthy Neighborhood
- Wellbeing
- Social Cohesion
- Climate Mitigation & Adaptation
- Urban Green
- Criteria
- Scores & Scales

LEARNING OBJECTIVES

After a successful completion of this project, the student will be able to:

- Work with the scientific / knowledge-based design approach (8 steps)
- Conduct a scientific literature study
- Create a measuring tool based on the findings of the literature study
- Define urban green characteristics, operationalize measuring those characteristics, translate the measurements into scores and scales, combine subscores into a total score
- Apply the tool on a neighborhood. GIS may be a useful tool to assist in this.
- Discuss the findings of the tool application
- Propose and detail out concrete interventions aimed at increasing benefits derived from urban green in the neighborhood

Project Making sustainable real estate feasible

Course code	Course level	Offered by	Year	Quartile
7PU1B20	Deepening	USRE	2	Q1

SHORT DESCRIPTION

"This project is the first in the series of four ffered in the SURE-track and focusses on the building and street level and the theme of Sustainability.
Due to the growth of the population, an enormous demand for dwellings and other real estate, and the negative influence of vacant buildings on the quality of life, the discussion about the transformation potential of existing real estate has been resurrected. This offers real challenges for urban planners, designers, developers, and managers.
In this project, various strategies are developed and evaluated to transform an existing building complex into a complex that meets market-driven needs and current and future demands, including sustainability, financial feasibility and risk analysis as well as other trends and developments.

CONCEPTS

- Real Estate
- Building complex
- Stakeholders
- Transformation
- Strategy development
- Needs & demands

LEARNING OBJECTIVES

After a successful completion of this project, the student will be able to:

- Work with the scientific / knowledge-based design approach (8 steps)
- Perform an analysis to position the real estate object in its immediate urban environment as well as in a regional / broader context and formulate a concise problem statement
- Conduct a (scientific) literature study with regard to the needs and preferences
- Specify the objective of redeveloping the real estate object and define a program of requirements
- Propose several possible interventions and evaluate the interventions systematically
- Translate the best intervention into a conceptual spatial plan/design
- Investigate the financial consequences of the intervention as well as the risks within the (re) development processes

Project Smart Cities

Course code	Course level	Offered by	Year	Quartile
7EU5B20	Advanced	USRE	3	Q4

SHORT DESCRIPTION

New societal trends such as aging, climate change, and urbanization are posing significant challenges to our cities. However, emerging technological trends are aiming to tackle these challenges in smart ways (i.e.; shared mobility, smart grids). As a result of these dynamics, life in cities will change substantially. These trends will cause buildings, public spaces, and transportation systems to be used differently. This offers real challenges for urban planners, developers, and managers to plan the future of our cities.

In response, this project will engage small groups of students in the exploration and evaluation of various scenarios for future urban development. In addition, through hands-on assignments and exercises, students will learn programming in NetLogo, a powerful agent-based modeling tool for simulating complex urban systems.

CONCEPTS

- Smart Cities
- Smart Urban Trends
- Urban Systems
- Agent-Based Modeling
- Urban Environment Simulation
- Behavior Modeling
- Key Performance Indicators
- Socio-Technical Systems

LEARNING OBJECTIVES

After this project, students are able to:

- Model the impact of trends and their interplay on an urban area as a physical system
- Model the behavior and activities of people and institutions in an urban area by means of probabilistic and/or deterministic approaches
- Reveal and describe technological, demographic, societal, and/or climatic developments and to transform these developments into scenarios
- Use agent-based programming software (namely Netlogo) and code with Logo programing language to model and simulate the urban system
- Assess by means of simulation the likely effects of scenarios on activities of people and institutions in urban areas
- Interpret results in terms of ‘smart development’ and report these results systematically
- Discuss the validity of assumptions made in the course of the project
- Advise planners, policy makers and managers about smart urban development

Students have knowledge about:

- Understand the aspects of smart cities
- Defining urban structures and physical elements in urban areas
- Describing activities of people and institutions in urban areas
- Describing behavior of trends, their impacts and interplay in urban areas
- Applying simulation (via Netlogo software) for simulating the activities of people and institutions in urban areas and the impact of trends in urban areas
- Evaluating the consequences of future developments and trends on urban areas

Project Urban mobility

Course code	Course level	Offered by	Year	Quartile
7PU3B20	Deepening	USRE	2	Q3

SHORT DESCRIPTION

This project is the third in the series of four offered in the SURE-track and focusses on the city level and the theme of Urban Mobility. Ensuring the sustainability of urban mobility is crucial for building resilient cities and addressing environmental and societal challenges. By prioritizing sustainable transportation, we not only reduce carbon footprints but also enhance the overall well-being of communities, promoting efficiency, equity, and a healthier urban environment. This project is about making urban mobility more sustainable. It involves comprehensive explorations of innovative solutions and strategic planning to foster a more accessible and environmentally-friendly urban mobility landscape that caters to the needs of its inhabithants.

CONCEPTS

- Sustainable Transportation
- Emerging Technologies
- Innovative Transport Concepts
- Multimodal Mobility
- Citizen Awareness
- Citizen Behavior

LEARNING OBJECTIVES

After a successful completion of this project, the student will be able to:

- Work with the scientific/knowledge-based design approach (8 steps)
- Conduct a scientific literature study focusing on relevant urban mobility topics related to sustainable transportation and develop a conceptual framework based on synthetized findings
- Map current transportation systems in an urban area, pinpointing areas of challenges and potential improvement. GIS may be a useful tool to assist in this
- Explore data collection methodologies designed to address specific aspects of urban mobility (for example, survey design)
- Execute the collection of relevant data using the chosen methodology, demonstrating practical skills in the acquisition of information related to urban mobility
- Interpret collected data by using appropriate analysis techniques and utilyzing the developed conceptual framework
- Propose innovative interventions and/or strategies based on a synthesis of literature, empirical findings, and a systematic assessment of urban contexts. This includes applying a systematic approach to select specific strategies considered most effective in achieving the goal of making urban mobility more sustainable

Project Urban restructuring

Course code	Course level	Offered by	Year	Quartile
7PU4B20	Deepening	USRE	2	Q4

SHORT DESCRIPTION

This project is the last in the series of four offered in the SURE-track and integrates all levels involved. Cities are never finished; there is always room for improvement. To be resilient, cities have to adapt to changes in the way we live, work, move around and spend our free time, and of course to changes in the environment and our climate. To know how to adapt, it is important to realize that changes in the system on city level are connected to changes in the system of our streets and vice versa. And all those changes affect the people using the city, so they have a stake in the matter. This makes it very interesting and challenging to decide what changes are needed in the urban fabric and how to make them happen. In this course, you will experience that thinking process and work on a plan to restructure an urban area. While working on a design, plan or strategy, you will have to consider the strengths and weaknesses of the city on different scales, current events that influence the city, and the role and opinion of parties that are involved.

CONCEPTS

- Urban redevelopment
- Urban analysis
- Urban strategy
- Societal trends
- Stakeholders
- Spatial plans
- Scale
- Integral design

LEARNING OBJECTIVES

After a successful completion of this project, the student will be able to:

- Work with the scientific / knowledge-based design approach (8 steps; this project focuses on steps 2 to 8
- Identify and implement different territorial scales (city, district and neighbourhood) and describe the way these are linked to each other
- Analyse and identify the problems and potentials of a city and/or project areas with regard to its physical, social, economic and cultural structures
- Identify relevant stakeholders and their role
- Translate the results of an analysis into conclusions, visions and plans (SWOT, redevelopment vision, program of requirements, spatial plans, phasing plan, environmental plan)
- Present visions and plans with clear and convincing visuals

Quantitative Research Methods and Statistics

Course code	Course level	Offered by	Year	Quartile
7U0B20	Advanced	USRE	2	Q1

SHORT DESCRIPTION

Planners, designers and engineers determine to an important extent how the built environment is shaped. Making good design or planning decisions is not possible without good information about the physical environment and the users for which we build. In this course, you will learn how to set-up a an experiment, develop a survey, and analyze the data in a statistically sound way.

CONCEPTS

- Empirical cycle
- Conceptual model
- Research instrument
- Reliability and validity of measurement method
- Measurement levels
- Sample and population Hypothesis testing
- Univariate and bivariate statistical analysis (t-tests, Chi-square test, ANOVA, correlation
- Multivariate statistical analysis (regression analysis)
- Multicollinearity
- Dummy coding
- Non-parametric analysis techniques
- Sampling methods

LEARNING OBJECTIVES

At the end of the course:

- Students are able to set up a research according to the method of the empirical cycle (formulating a research question, developing a conceptual model, designing a research instrument and determining a sample)
- Students know how to apply basic techniques of statistical testing (one-sample t-test, two-samples t-tests, Chi-square test, ANOVA, correlation, linear regression analysis and non-parametric methods)
- They know which statistical technique should be used for which analysis problem and verify the conditions for using the technique
- They know how to interpret the analysis results within the conceptual model and draw conclusions with regard to the formulated research questions
- They are able to use state-of-the-art statistical software

Transportation Engineering

Course code	Course level	Offered by	Year	Quartile
7EU2B20	Introductory	USRE	2	Q1

SHORT DESCRIPTION

This course presents and discusses various aspects of planning in the urban environment from both a scientific and a societal point of view, encompassing ideas on sustainable mobility, accessibility of services and facilities, urban green and healthy living, sustainable tourism and choice behavior, inner city transformation processes and stakeholder roles. The most current theories and research in urban systems and environmental development are addressed and related to contemporary cities' social, environmental, and ecological challenges. The development of urban plans and their juridical status is discussed, and urban planning policy in the Netherlands at the different governmental levels and the relation with Europe is presented. Urban plans at different spatial levels will be presented and discussed regarding the theories and studies dealt with in this course, and the learning material will be applied in a challenge-based learning assignment.

CONCEPTS

- Walking
- Cycling
- Driving
- Riding
- Networks
- Services
- Road/Streets
- Intersections
- Parking
- Bus Stops

LEARNING OBJECTIVES

At the end of the course students are able to…

- To understand various elements of urban infrastructure for slow traffic, public transport, and motorized traffic
- To apply developments regarding urban infrastructure like sustainable safety, shared space, and context sensitive street design
- To use standards regarding dimensions, use of materials, and acceptable traffic densities

Urban planning

Course code	Course level	Offered by	Year	Quartile
7U0B30	Deepening	USRE	3	Q1

SHORT DESCRIPTION

This course presents and discusses various aspects of planning in the urban environment from both a scientific and a societal point of view, encompassing ideas on sustainable mobility, accessibility of services and facilities, urban green and healthy living, sustainable tourism and choice behavior, inner city transformation processes and stakeholder roles. The most current theories and research in urban systems and environmental development are addressed and related to contemporary cities' social, environmental, and ecological challenges. The development of urban plans and their juridical status is discussed, and urban planning policy in the Netherlands at the different governmental levels and the relation with Europe is presented. Urban plans at different spatial levels will be presented and discussed regarding the theories and studies dealt with in this course, and the learning material will be applied in a challenge-based learning assignment.

CONCEPTS

- Urban planning
- Urban system
- Spatial plan
- Planning theories
- Planning policy
- Sustainable mobility
- Sustainable tourism
- Healthy living environment
- Urban green
- Accessibility
- Inner city
- Urban planning stakeholder
- Urban challenges

LEARNING OBJECTIVES

At the end of the course students will be able to....

- Describe the Dutch policy about urban planning at various governmental levels and the relation with Europe
- Can explain the most important theories and are familiar with research in urban systems and environmental development concerning contemporary cities' social, environmental, and ecological challenges
- Can critically review and discuss urban plans based on Dutch and European spatial policies, important spatial theories and empirical research, taking the societal context of urban planning into account

Furthermore, the student develops their:

- Presentation skills
- Writing skills

Urban Projects & Finance

Course code	Course level	Offered by	Year	Quartile
7U1B30	Advanced	USRE	3	Q2

SHORT DESCRIPTION

This course provides an introduction into the financial and strategic aspects of area development such as land exploitation calculations, value capturing, development strategy, and risk management.

CONCEPTS

- Financial Basics
- Area Development
- Real Estate Development
- Real Estate Exploitation
- Risk Management
- Real Estate Tax
- Development Strategy

LEARNING OBJECTIVES

At the end of this course, students are able to:

- Estimate the financial feasibility of an area development by means of land development calculations
- Distinguish and explain the principles of development and cooperation strategies
- Explain the systematics of and the Dutch instruments for real estate tax
- Estimate the financial consequences of sustainability measures in real estate developments
- Execute a risk analysis and identify measures to control risks

Multidisciplinary CBL

Course code	Course level	Offered by	Year	Quartile
4CBLW00	Advanced	Mechanical Engineering	2	Q4

SHORT DESCRIPTION

In this course, you and your multidisciplinary team will address an open challenge in either Engineering Design or Scientific Inquiry.

CONCEPTS

Concepts covered depend on the subject of the project.

LEARNING OBJECTIVES

All programs within the Bachelor College offer at least one Challenge-Based Learning (CBL) project per semester during the first and second years. This course is a part of that sequence, providing students with the opportunity to collaborate and communicate in multidisciplinary teams while working across borders and disciplines.
Students can select from a variety of challenges presented by different combinations of at least two departments. Each project addresses an open challenge in either Engineering Design or Scientific Inquiry. Challenges are intentionally designed to be complex and extensive, requiring more than even a considerably experienced team within a larger timeframe. Therefore, the initial step for students in a project is to define a research question or design goal that they can reasonably address within the course's timeframe.
Projects follow a structured format and adhere to the timeline of a linear design process, such as the Classical Engineering model, the CBL framework ""Engage – Investigate – Act,"" the Double Diamond model, or the Design Thinking model. These models share characteristics of subsequent diverging and converging phases, along with iterative processes.
In essence, CBL projects are open to all TU/e students who are eligible, allowing students the freedom to choose. However, certain projects may require specific knowledge. Information about projects can be found in the TU/e Education Guide to match individual profiles and preferences. During enrollment in Osiris, students are required to provide a list of preferred projects. The course organization reviews preferences, profiles, and student caps, enrolling students in projects accordingly. Efforts will be made to achieve an optimal distribution based on student preferences and multidisciplinarity within groups. However, it is important to note that there is no guarantee that students will be assigned to their preferred project.

At the end of this course, students are able to:

- Understand, evaluate, and execute an open design process or an open scientific inquiry,
- Acquire, apply, and integrate (new) disciplinary knowledge and skills (self-directed, student-controlled),
- Collaborate in a multidisciplinary team,
- Provide and receive constructive feedback through peer- and self-assessment
- Act responsibly in every stage of the project, considering societal and environmental impact
- Understand and apply project-specific disciplinary knowledge (optional)

ITEC – Engineering for Society

Course code	Course level	Offered by	Year	Quartile
0LVX20	Deepening	IE&IS / P&E and TIS	3	Q3

SHORT DESCRIPTION

This course, ITEC- Engineering for Society, is a mandatory course for all 3rd-year Bachelor students. ITEC stands for 'Impact on Technology', and this course will focus on theoretical and practical frameworks for assessing and designing responsible innovations for overcoming social challenges, such as aging, privacy, climate change, traffic safety, etc.

The course will consist of three parts:

1. Three central lectures of TU/e-top-researchers in their field. These researchers will show that technological research plays a significant and dependable way to understand and solve the complexity of numerous social problems faced by humanity.
2. Deepening three online modules about 'assessment methods'. In these modules, students will study, practice with, and complete a range of exercises about assessment methods, such as risk analysis, cost-benefit analysis, life cycle analysis, and systems thinking and systems analysis.
3. Case assignments. In three group assignments, students will apply the theory learned in the online modules based on a case students have chosen, such as digital twins, autonomous cars, care robots, smart urban lighting, and human crowd dynamics.

LEARNING OBJECTIVES

After this course, students are able to:

- Explain the scope of engineers' social and moral responsibilities in light of the societal impact of technological innovations (LO1)
- Reflect on the changing nature, impact, and responsibilities of the engineering profession (LO2)
- Explain the several qualitative and quantitative assessment methods, such as cost-benefit analysis, life-cycle analysis, and Value Sensitive Design (LO3) that can be used to evaluate the environmental and societal impact of technology
- Identify value conflicts in a design process, for example relating to costs and benefits, risks, and non-financial social and environmental impacts of technological change (LO4)
- Apply qualitative and quantitative assessment methods in making morally justified decisions in engineering design concerning public values, such as sustainability, equality, and privacy (LO5)
- Evaluate the effectiveness of different assessment methods with regard to designing responsible innovations (LO6)

Courses year 2 & 3 that transition to the new program

	Current Course code	New Course code	Course name	Unit	Course type
1	7NN(8/9)X0	7P1B30	Multidisciplinary Project	All units	Core
2	7T8X0	7A0B30	Architecture and Technology	AUDE	Elective
3	7OO7X0	7PA1B20	AUDE project 1: Making & Structure	AUDE	Core
4	7OO6X0	7PA2B20	AUDE Project 2: Program & Typology	AUDE	Core
5	7OO5X0	7PA3B20	AUDE Project 3: Housing & Public Space	AUDE	Core
6	7OO4X0	7PA4B20	AUDE Project 4: Urban Design & Landscape	AUDE	Core
7	7AUX0	7A2B30	Bachelor End Project AUDE 1 architecture, AUDE 2 urbanism and architecture	AUDE	Core
9	7XEUA0	7EA1B20	Design for a Sustainable Future	AUDE	Elective
10	7X7X0	7EA3B20	Geometry & Form	AUDE	Elective
11	7X3X0	7A1B20	Histories of Architecture and Urbanism	AUDE	Core
12	7W0X0	7EA2B20	Landscape & Public Space	AUDE	Elective
15	7X0X0	7A3B20	Qualitative Research and Design-oriented Methods	AUDE	Core
16	7X8X0	7EA6B20	Spatial Imagination	AUDE	Elective
17	7X9X0	7EA5B20	Tectonics & Materiality	AUDE	Elective
20	7X2X0	7EA9B20	Urban Case Study	AUDE	Elective
21	7XWX0	7EA4B20	Urbanism & Architecture in context	AUDE	Core & Elective
22	7W2X0	7EA8B20	Walkscapes	AUDE	Elective
23	7BPX0	7B2B30	Bachelor End Project BPS	BPS	Core
25	7S9X0	7B0B30	Building Performance	BPS	Core & Elective
26	7S8X0	7B1B30	Building Services	BPS	Core & Elective
29	7S7X0	7EB2B20	Materialization of facades and roofs	BPS	Core & Elective
30	7hk30	7EB1B20	Physics of light and lighting design	BPS	Core
34	7S0X0	7B0B20	Urban Physics	BPS	Core
35	0HVL10		Healthful environments: light, wellbeing and the biological clock	IE&IS	Elective
36	2DBA0		Matrices and Differential Equations	M&MC	Core & Elective
37	2IAB1		Foundations of Data Analytics	M&MC	Core
38	7SDX0	7S2B30	Bachelor End Project SED	SED	Core
39	7P9X0	7S0B30	Concrete and Masonry Structures	SED	Core & Elective
51	7P0X0	7S1B20	Steel Structures and Applied Mechanics	SED	Core & Elective
52	7P8X0	7S2B20	Timber Structures and Applied Mechanics	SED	Core
53	7P1X0	7ES2B20	Experimental research of structures and materials	SED by M&MC	Core
54	7USRX0	7U2B30	Bachelor End Project USRE	USRE	Core
55	7GC20	7EU4B20	Design project Smart Mobility	USRE	Elective
57	7U8X0	7EU6B30	Geographic modeling of the built environment	USRE	Elective
58	7UUX0	7EU0B20	Housing, RE & urban Economics	USRE	Core
59	7W4X0	7EU3B20	Mobility and Forecasting	USRE	Elective
62	7M6X0	7EU5B20	Project Smart Cities	USRE	Elective
64	7PP7X0	7PU4B20	Project Urban restructuring	USRE	Core
65	7U9X0	7U0B20	Quantitative Research Methods and Statistics	USRE	Core
66	7W9X0	7EU2B20	Transportation Engineering	USRE	Elective
67	7W7X0	7U0B30	Urban planning	USRE	Core
68	7GC20	7U1B30	Urban Projects & Finance	USRE	Core
72	7CB2	7IBP2BE	Information Bachelor's program year 2 AUBS	BE	Core
73	7CB3	7IBP3BE	Information Bachelor's program year 3 AUBS	BE	Core
74	7N0X0	7ES3B20	Practical assignment “Bouwkundewinkel”	BE	Elective

COLOFON

This Course Guide is part of the redesign process of the bachelor college curriculum at the department of the Built Environment, Eindhoven University of Technology

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