Unite! VECP on Architecture Engineering

is a Virtual Exchange Credit Program (VECP) in Unite! – the University Network for Innovation, Technology and Engineering. Students in Architecture and Civil engineering from Aalto-yliopisto, Politecnico di Torino and Technical University of Darmstadt can select one or more online courses offered by the other universities and gain credits.

- **Level:** Master of Science in Architecture/ Civil Engineering
- **Period**: starting fall/winter 2021
- **Language of instruction:** English
- **Mode of Instruction:** Virtual

Topics: Architecture, Engineering, Digital Design and Construction, Sustainability, Advanced Manufacturing, Energy Efficiency, Parametric Design, Algorithmic Design, Structural Design

Summary of Courses offered

When reading the course information below, please pay attention to the different academic calendars, day and hour of the course and the course requirements. If you have questions on whether the course fits your study plan, please contact your professors or an academic advisor at your home institution.

University	Lecturer	Course Name	Credits	Time Frame	Application Possible	UNITE! Student Numbers
Technische Universität Darmstadt (Germany)	Oliver Tessmann (DDU)	Computational Design Basics	5	Summer (April to July) and Winter Semester (October to February)	Yes	7 from each partner 14 UNITE!
		Parametric Design and Construction	3/5*	Summer (April to July)	March 1	2 from each partner 4 UNITE!
	Ulrich Knaack (ISM+D)	Facade Technologies 1	6	Summer (April to July) and Winter Semester (October to February)	Yes	7 from each partner 14 UNITE!
	Jens Schneider	Spatial Structures	6	Summer (April to July)	March 1	5 from each partner 10 UNITE!
Aalto University (Finland)	Toni Kotnik	Parametric Design	3	January -February / Period 3 (6 weeks)	Yes	2 from each partner 4 UNITE!

	Toni Kotnik	Algorithmic Design	3/6*	March -May /Period 4 and 5 (12 weeks)	Yes	2 from each partner 4 UNITE!
Politecnico di Torino (Italy)	Ilaria Butera	Green water for sustainable building	6	Summer Semester (March to Jun)	Yes	3 from each partner 6 UNITE!
	Vincenzo Corrado	Energy performance design and indoor environmental quality	8	Winter and Summer Semester (Oct to Jan and March to June)	Yes	3 from each partner 6 UNITE!
*CP without/with Design Project						

Workload/ Prerequisites/ Course Literature: For the courses listed above please consult both the detailed course description and web link. Some courses have special prerequisites, please check the weblinks which provide information about literature required and further assessment guidelines and exams. Please contact the course professors if you require more information.

Application information

Students apply at the home institution until **Nov 13th 2021(extended to March 1st 2022)** for courses in fall 2021/winter semester 2021/22. A maximum of three courses can be selected at one of the partner universities.

- Application information for students from Aalto University
- Application information for students from Politecnico di Torino
- Application information for students from TU Darmstadt

The applications will be processed at the home institution and the students will be nominated to the host institution. You will receive information about the second application to be filled-in at the host institution in late May or June. After successful application at the host institution, you will be enrolled at the host institution. You will have to register for the selected courses before the semester starts.

Contacts for the Architecture Engineering Pilot

Aalto-yliopisto

Iina Ekholm, International Relations Manager, School of ARTS, Aalto University, iina.ekholm@aalto.fi

Johanna Kaila, Unite! planning officer, johanna.kaila@aalto.fi

Politecnico di Torino

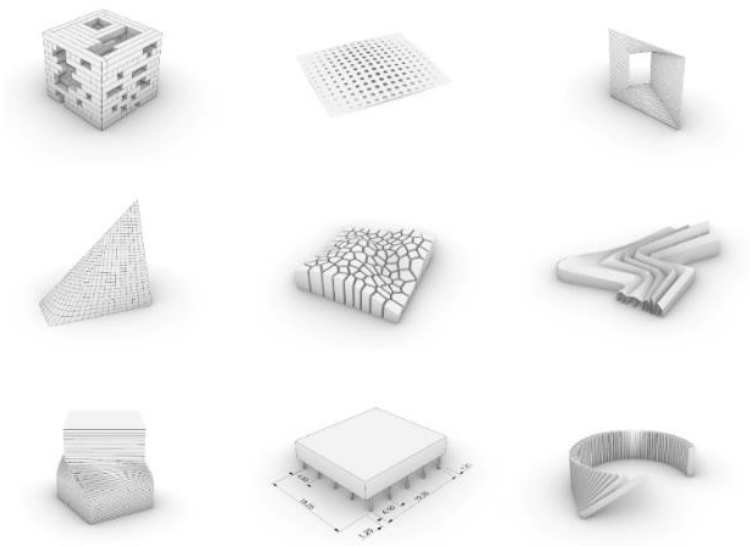
International Affairs Area - Incoming & Outgoing Units
Outgoing students: mobilita.studenti@polito.it
Incoming students: incoming.students@polito.it

TU Darmstadt

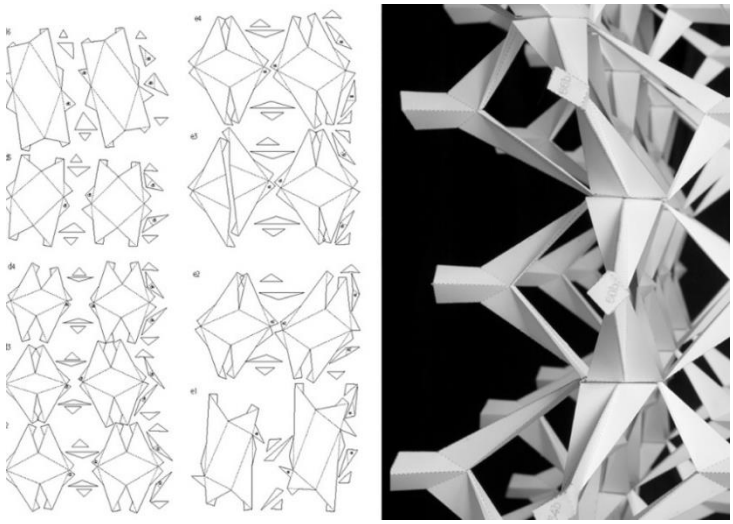
International Relations & Mobility
Outgoing students: europe-outgoings@zv.tu-darmstadt.de
Incoming students: europe-incomings@zv.tu-darmstadt.de

Architecture Valentina Visnjic Lang: visnjic@architektur.tu-darmstadt.de
Civil Engineering: Dr. Regine Sauerwein: international@bauing.tu-darmstadt.de

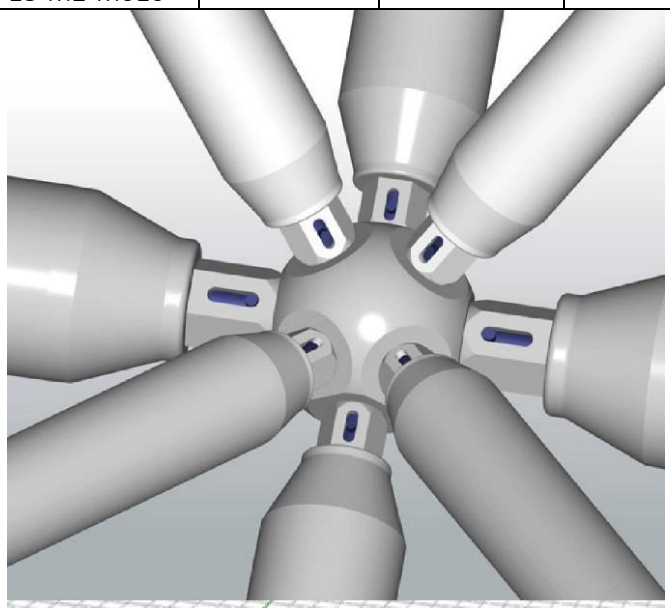
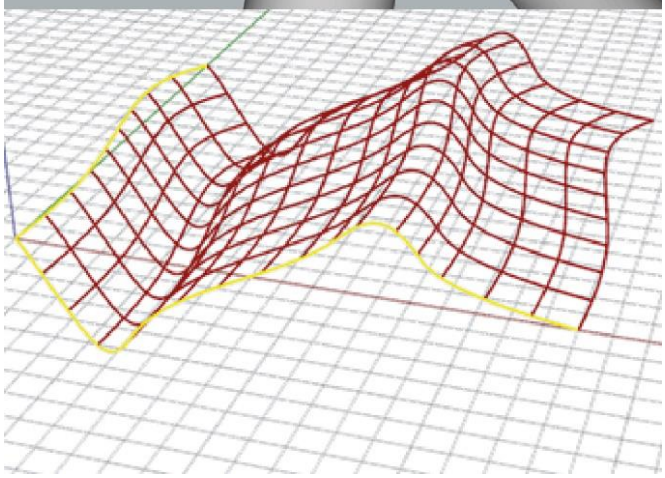
Detailed List of Courses offered from 2021/2022

Module: Computational Design Basics	**Module Number** 15-02-6466/ 15-02-0422 (FM B)	**Credits** 3/5 CP	**Effort** 90/150 Hrs	**Self Study** 60/120 Hrs
The course introduces students to the tools and methods of computational design. Students will be introduced to 3d modeling techniques with Rhinoceros, parametric and algorithmic design with Grasshopper, and scripting with Python. The course is thought as an introduction to the different tools used in computational design, and it is beneficial particularly for students interested in continuing their research in the field of digital design and fabrication.				
Lecturer	Prof. Dr.- Ing. Oliver Tessmann			
Course dates (TBC)	Mid. October to Mid. February Winter/ Mid. April- Mid. July Summer semester			
Times (TBC)	Fri, 12.30 – 14.30			
Delivery Method	Moodle			
Assessment/Exam	After introduction to all the tools, students will be asked to develop a personal project, applying the learned tools in one of these four areas: digital fabrication, discrete modelling, generative design, environmental modelling, followed by an exam.			
Language	English			
Contact and Weblink	tessmann@dg.tu-darmstadt.de			
https://www.architektur.tu-darmstadt.de/media/architektur/2019_studieren/downloads_5/fb_15_allgemein/semesterbooklet/vergangenes_semester/Semesterbooklet_WS19-20.pdf Modulhandbuch B.Sc. Architektur: **15-02-0422** Page 14 / repeatability unlimited (Studienleistung) **15-02-6466** Page 34 / repeatability unlimited (Studienleistung)				

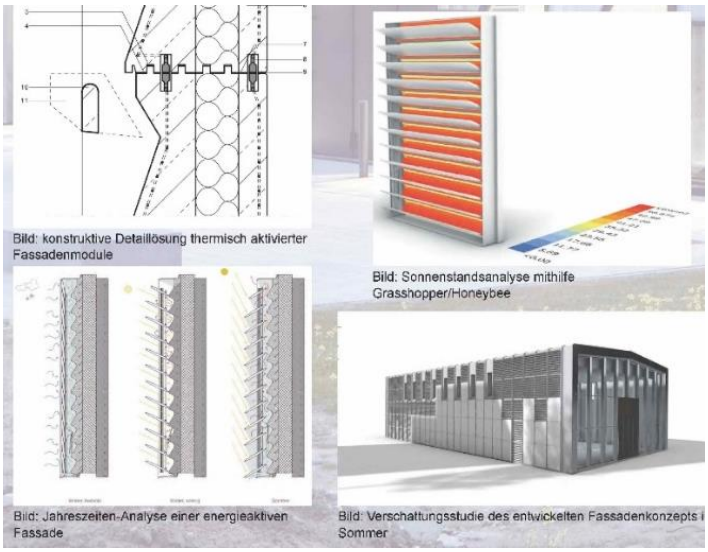
https://www.architektur.tu-darmstadt.de/media/architektur/2019_studieren/downloads_5/msc_architektur/studienordnung_2014/FB_15_3_MSc_Architektur_Modulhandbuch.pdf

Module: Parametric Design and Construction	**Module Number** 15-02-6465/ 15-02-0422	**Credits** 3/5 CP	**Effort** 90/150 Hrs	**Self Study** 60/120 Hrs
The Parametric Design and Construction course consists of a series of lecture, tutorials and design exercises. Parametric Design unlocks novel design possibilities and enables interdisciplinary collaboration of architects and structural engineers. These tools and methods will be applied and explored for the design of lightweight spatial structures. In this course participants will learn about space frame structures and their properties through examples from practice and a series of small design exercises. 3D modelling, parametric and structural design calculations will be conducted in Rhino, Grasshopper and Karamba. The course is linked to the Spatial Structures in the TU Da Engineering department. Architects and engineers will collaborate in interdisciplinary design teams.				
Lecturer	Prof. Dr.- Ing. Oliver Tessmann			
Course dates (TBC)	30th April to 10th July **Summer semester only**			
Times (TBC)	Monday, 14.30 – 18.00			
Delivery Method	TU ID access to Moodle content/ TUCaN or direct email			
Assessment/Exam	The exam consists of one colloquium and three small design exercises.			
Language	English			
Contact and Weblink	tessmann@dg.tu-darmstadt.de			
https://www.architektur.tu-darmstadt.de/media/architektur/2019_studieren/downloads_5/fb_15_allgemein/semesterbooklet/Semesterbooklet_SoSe_2021.pdf Modulhandbuch M.Sc. Architektur: **15-02-0422** Page 14 / repeatability unlimited (Studienleistung)				

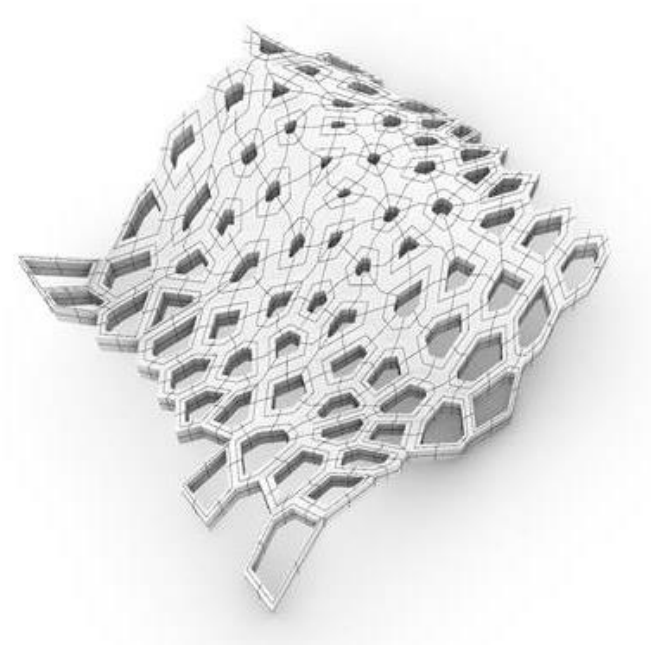
15-02-6465 Page 34 / repeatability unlimited (Studienleistung)
https://www.architektur.tu-darmstadt.de/media/architektur/2019_studieren/downloads_5/msc_architektur/studienordnung_2014/FB_15_3_MSc_Architektur_Modulhandbuch.pdf

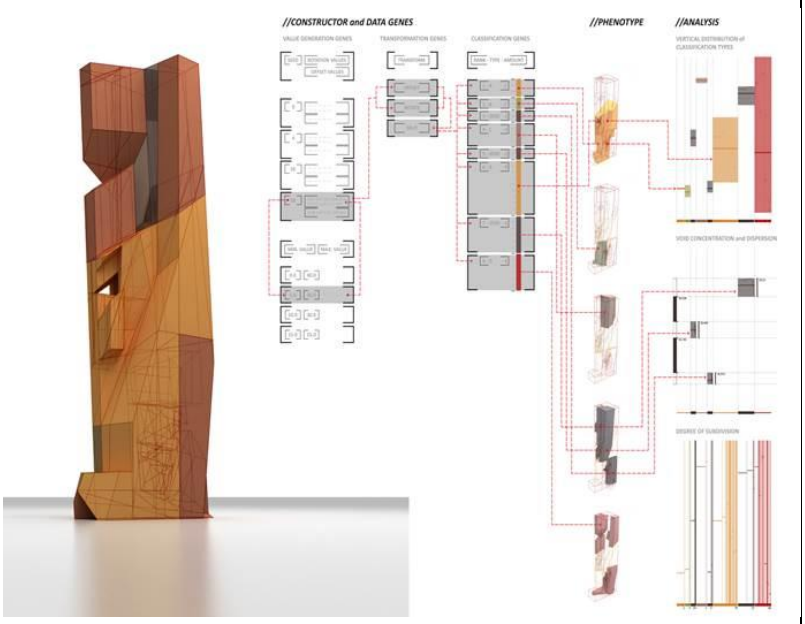
Module: Spatial Structures	**Module Number** 13-M2-M010	**Credits** 6 CP	**Effort** 180 Hrs	**Self Study** 120 Hrs
The Spatial Structures course consists of a series of lecture, tutorials and design exercises that revolve around the design, analysis and fabrication of spatial structures. Lightweight spatial, vector-active structure allow for large spanning constructions. Parametric design and digital fabrication allow for ever more complex geometries. The lecture address basic characteristics of spatial structures and presents contemporary and historical examples from practice. The course is held as an interdisciplinary event in cooperation with the department Digital Design Unit (DDU) of the Department of Architecture. In this course participants will learn about space frame structures and their properties through examples from practice and a series of small design exercises. 3D modelling, parametric and structural design calculations will be conducted in Rhino, Grasshopper and Karamba. **Recommended:** Statics II (13-M2-M002), Steel Construction I (13-I1-M007)	 			
Lecturer	Prof. Dr.-Ing. Jens Schneider			
Course dates (TBC)	30th April to 10th July **Summer semester only**			
Times (TBC)	Monday, 14.30 – 18.00			
Delivery Method	Moodle content/ TUCaN or direct email			
Assessment/Exam	Subject examination: Oral examination (30 min., 3 attempts); Study achievement: 3 homework Assignments (total 90 hours, unlimited number of attempts)			
Language	English			
Contact and Weblink	schneider@ismd.tu-darmstadt.de			

Räumliche Stabwerke – Institut für Statik und Konstruktion – TU Darmstadt (tu-darmstadt.de)
Modulhandbuch M.Sc. Bauingenieurwesen – Civil Engineering (2021): TUCaN_MHB_M.Sc._BI-CE_2021_2021-05-07.pdf (tu-darmstadt.de)

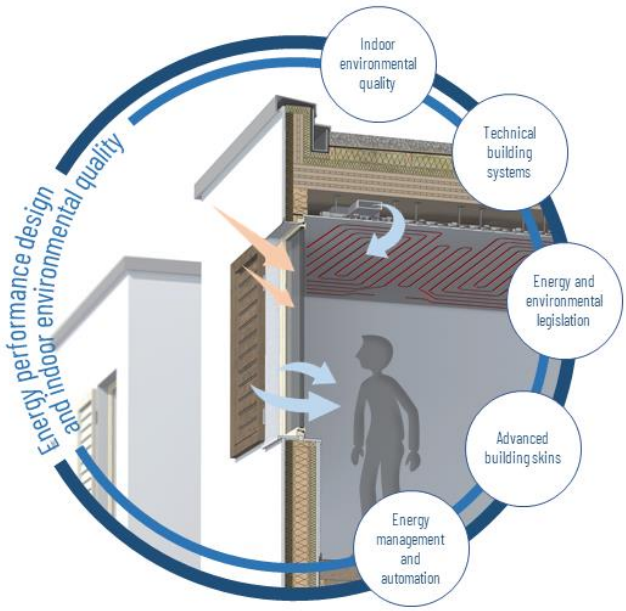
Module: Façade Technologies 1	**Module Number** 13-M4-M002	**Credits** 6 CP	**Effort** 180 Hrs	**Self Study** 120Hrs
In view of the national and international climate targets, energy-efficient and energy-flexible facades play an increasingly important role. One current topic is "energy-active facades", which maximise the use of regenerative environmental heat for room air conditioning, while minimising the use of fossil fuels and complex heating and cooling technology. In addition to the lecture, a workshop will be held in which the students will develop a facade mockup which provides for thermal activation on both the outside and inside of the facade in order to absorb heat energy, store it temporarily and release it again at a suitable time. The design, construction and energy performance of the facade system are evaluated. As a tool for the design of the energy-active, inhomogeneous component in COVID-19 teaching, the participants use CAD program and a multiphysics tool for the analysis of heat storage capacity and transfer.				
Lecturer	Prof. Dr.-Ing. Ulrich Knaack			
Course dates (TBC)	1st October to 18th February Winter/ 30th April to 10th July Summer semester			
Times (TBC)	Wed. 13:30 – 15:00			
Delivery Method	Zoom and Direct Email			
Assessment/Exam	Subject examination: Oral examination (15 min., 3 attempts); Study achievement: Term paper (unlimited number of attempts)			
Language	English			
Contact and Weblink	knaack@ismd.tu-darmstadt.de			

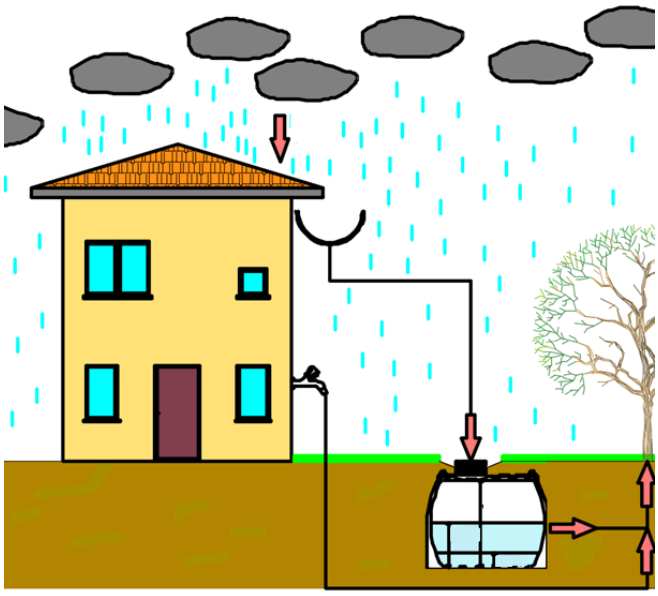
Fassadentechnik I – Institut für Statik und Konstruktion – TU Darmstadt (tu-darmstadt.de) Modulhandbuch M.Sc. Bauingenieurwesen – Civil Engineering (2021): TUCaN_MHB_M.Sc._BI-CE_2021_2021-05-07.pdf (tu-darmstadt.de)

Module: Parametric Design	**Module Number** ARK-E2515	**Credits** 3CP	**Effort** 81 Hrs	**Self Study** 45 Hrs
The course is an introduction into fundamental concepts of parametric design thinking in architecture and landscape architecture using Grasshopper (Rhinoceros plug- in). The course covers basics of geometry of curves and surfaces, NURBS-geometry and mesh geometry as well as data handling. It is taught as intense one-week long workshop at the beginning of the summer teaching period. Basic knowledge of parametric design thinking, the transformation of concepts into geometric operations and the implementation of these operations in a graphic scripting editor. **Requires:** Knowledge of Rhinoceros (basic knowledge NURBS curves surfaces).				
Lecturer	Prof Dr Toni Kotnik			
Course dates (TBC)	January -February / Period 3 (6 weeks)			
Times (TBC)	Tuesday 09.15-12.00			
Delivery Method	Moodle			
Assessment/Exam	Assessment is based on the evaluation of the exercises and the final design exercise. Participants need to submit successfully two Homework Exercises provided during the course and apply the skills to a small design exercise at the end of the course. 15 h of input lecture 20 h of exercise work. Re-submission of Exercises possible in consultation with teacher.			
Language	English			
Contact and Weblink	toni.kotnik@aalto.fi			
https://oodi.aalto.fi/a/opintjakstied.jsp?html=1&kieli=6&Tunniste=ARK-E2515&Ajankohta=12-01-2021				

Module: Algorithmic Design	**Module Number** ARK-E2515	**Credits** 6 CP	**Effort** 160 Hrs	**Self Study** 90 Hrs
The course deals with methods of algorithmic design applied to the field of architecture, landscape and interior architecture, construction, as well as in the broad fields of industrial and product design. Although many architects still use computers much like they used analogue drawing boards, intrinsic capabilities of computers allow them to formalize their designs through code. This approach also captures and exploits the inherent contemporary condition of creative practices - when designs become data, it becomes possible to create what was previously undrawable. **Requires:** Basic knowledge of algorithmic design with ability to write and execute own Python scripts as well as formulate design problems in code.				
Lecturer	Prof Dr Toni Kotnik			
Course dates (TBC)	March -May /Period 4 and 5 (12 weeks) Spring			
Times (TBC)	Tuesday 09.15-12.00			
Delivery Method	Moodle			
Assessment/Exam	Students will be evaluated based on the project submitted at the end of the course. The submitted project needs to follow the guidelines which will be clearly communicated in the task description together with reference examples at the beginning of the course. 30 h of input lecture, 40 h of exercise work. Re-submission of Exercises possible in consultation with teacher.			
Language	English			
Contact and Weblink	toni.kotnik@aalto.fi			
https://oodi.aalto.fi/a/opintjakstied.jsp?html=1&kieli=6&Tunniste=ARK-E2513&Ajankohta=02-03-2021&Kieli=6				

Module: Knowledge of the built heritage in the era of the climate changes	**Module Number** 01UWENB	**Credits** 18CP	**Effort** 450 Hrs	**Self Study** 270 Hrs
The course, carried out in the form of an interdisciplinary laboratory, aims to set the methodological elements of the entire course of studies in Green Building, providing innovative tools and methods for the integration and critical interpretation of heterogeneous data functional to the design, starting from the creation of a digital model on the building scale (the Digital Twin of the Green Building). The theoretical concepts are applied to a real case study shared by all the courses of the first year of the master's degree and refers to a building characterized by a constructive and formal identity that make it peculiar and representative in the context of the international heritage. **Requires:** Basic knowledge of BIM Fundamentals of programming, topography and cartography Basic knowledge of building physics.				
Lecturer	Prof. Dr. Anna Osello			
Course dates (TBC)	27th September to 15th January			
Times (TBC) (based on AY 2020/21)	Wednesday 08:30-13:00 – Thursday 14:30-19:00 Friday 08:30-13:00			
Delivery Method	Moodle and Zoom with Proprietary S/W tools			
Assessment/Exam	Compulsory oral exam; Group graphic design project. The exam is divided into two parts: (i) presentation (in group) of the Digital Twin of the Green Building with particular attention to data and process interoperability; (ii) oral exam (individual) for the verification of the theoretical contents of the course. Repetition of the exam possible in consultation with the teacher.			
Language	English			
Contact and Weblink	anna.osello@polito.it			
https://didattica.polito.it/portal/pls/portal/gap.pkg_guide.viewGap?p_cod_ins=01UWENB&p_a_acc=2021&p_header=S&p_lang=IT				

Module: Energy performance design and indoor environmental quality	**Module Number** 01UUVNB	**Credits** 8CP	**Effort** 200 Hrs	**Self Study** 120 Hrs
The course is aimed at providing the basic knowledge and the design skills in the field of the thermal behaviour and energy performance of buildings. Particular attention will be put on the evaluation of the indoor environmental requirements (thermal comfort, indoor air quality), on the thermal performance of the building envelope components, of the analysis of the built environment, on the design of technical building systems, and on the assessment of building energy performance. The course is organized in lectures, numerical exercises and experimental exercises. **Requires:** Basic knowledge of mathematics and of building physics (BSc level).				
Lecturer	Prof. Vincenzo Corrado			
Course dates (TBC)	27th September to 15th January + Spring/summer from 1st March to 11th June)			
Times (TBC) (based on AY 2020/21)	Winter semester: Thursday 11:30-13:00 – Friday 14:30-16:00 Summer semester: Thursday 10:00-13:00			
Delivery Method	Moodle and Zoom with Proprietary S/W tools			
Assessment/Exam	Compulsory oral exam; Paper-based written test with video surveillance of the teaching staff; Computer-based written test with open-ended questions or multiple-choice questions using the Exam platform and proctoring tools (Respondus); Group project. Repetition of the exam possible in consultation with the teacher.			
Language	English			
Contact and Weblink	vincenzo.corrado@polito.it			
https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01UUVNB&p_a_acc=2021&p_header=S&p_lang=				

Module: Green water for sustainable building	**Module Number** 01UUWNB	**Credits** 6CP	**Effort** 150 Hrs	**Self Study** 90 Hrs
In a context of climate changes, with long periods of water scarcity, a responsible management of water resources is mandatory also at the building scale. New trends are developing towards this goal (rain water harvesting, the use of vegetation, etc.). In this course, after covering the basic principles of hydraulics, attention will be paid to the design of the building water systems in view of a sustainable use of the water resource. After attending the course, the student is able to understand and manage hydraulics issues related to buildings, to read technical reports and national regulations dealing with water topics, to join new trends for water smart solutions at the building scale. **Requires:** Calculus, mass geometry, basic knowledge of mechanics.				
Lecturer	Prof. Ilaria Butera			
Course dates (TBC)	27th September to 15th January + Spring/summer from 1st March to 11th June)			
Times (TBC) (based on AY 2020/21)	Summer semester: Tuesday 10:00-11:30; Wednesday 14:30-16:00; Thursday 14:30-16:00			
Delivery Method	Moodle and Zoom with Proprietary S/W tools			
Assessment/Exam	The exam is made up by a written part (up to 30 scores) and an oral part (up to 30 scores). The final mark is made by the average of the scores obtained in the oral and in the written part. The candidate has to reach 18 scores in the written part to be admitted to the oral part. The written part assesses the ability to solve problems and some basic knowledge of the subject through 2 open exercises and 3 short questions (eventually quiz). No kind of material can be used during the written part, duration 1 hour. In the oral part, usually two questions, the design exercise and the topics carried out during all the classes are subject for the exam.			
Language	English			
Contact and Weblink	ilaria.butera@polito.it			
Didactic Portal (polito.it)				