MCAST

MCAST PROGRAMMES - PUBLIC INFORMATION TEMPLATE (FULL TIME)

Institute	Institute of Engineering and Transport
Department	Construction Engineering Department

Programme Title	Master of Science in High Performance Buildings						
Course Code *To be filled in by Admissions Dept.*	CE7-O13-21		**If the programme includes a WBL element, How is it accredited?**		Not Applicable, does not include WBL		
MQF/ EQF Level	Level 7	**Type** *(refer to Appendix 1 for Parameters)*	Qualification		**Awarding Body**	MCAST – Malta College of Arts, Science and Technology	
Accreditation Status		Accredited via MCAST's Self Accreditation Process (MCAST holds Self-Accrediting Status as per 1st schedule of Legal Notice 296/2012)					
Mode of Delivery	Face to Face		**Duration** *(Academic Years or Semesters)*	3 Semesters	**Mode of Attendance**	Full-time	
Total Number of Credits	90 credits	**Total Learning Hours** *(25 Total Learning Hours for each ECTS)*		2250 hours			
Target Audience	Ages 23 - 65	**Target Group** *(the type of learners that the educational institution anticipates joining this programme)*	-				
Programme Fees	There are no fees applicable to Maltese and other EU Nationals (as will be evidenced by their Identity Document) Fees apply for other International Applicants… for fee information and any related updates it is best to communicate with MG2i International through applyinternational@mcast.edu.mt One may consider checking about possible eligibility or otherwise for any exemption from fees by contacting the relevant section within MEYR (Floriana) – or visit the servizz.gov.mt website here						
Date of Next Student Intake	For further information regarding upcoming student intake and applications time windows for same kindly click here						
Language of Instruction	The official language of instruction at MCAST is English. All notes and textbooks are in English (except for language courses, which will be in the respective language being instructed). International candidates will be requested to meet English language certification requirements for access to the course.						
Application Method	Applications to full-time courses are received online via the College Management Information System. Applicants can log-in using Maltese Electronic ID (eID) in order to access the MCAST Admissions Portal directly and create one's own student account with the identity being verified electronically via this secure service. Non-EID applicants need to request account creation though an online form after that they confirm that their local Identification Document does not come with an EID entitlement. . Once the identity is verified and the account is created on behalf of the applicant, one may proceed with the online application according to the same						

	instructions applicable to all other applicants. For more information about how to apply online for a course at MCAST, please visit: https://mcast.edu.mt/how-to-apply-online-2/
Information for Non-EU Citizens	Non-EU candidates require a study visa in order to travel to Malta and join the course applied for (on a Full Time delivery mode). For further information re study-visa please access https://www.identitymalta.com/unit/central-visa-unit/. Further information International / TCN applicants should take note of before requesting to being considered for a programme of studies at MCAST, can be obtained through the respective FAQ found on https://mcast.edu.mt/important-information/
IMPORTANT note to Non-EU Nationals / TCNs	In instances where a TCN is applying for an MCAST programme of studies which includes Apprenticeship / Placement / Internship, it is the applicant's responsibility to check with the relevant Maltese Authority whether one would be eligible to have the necessary permits to be able to carry out the accredited Apprenticeship / Placement / Internship, success from which is expected in order to be able to successfully complete the selected programme of studies. Further information can also be obtained through the respective FAQ found on: https://mcast.edu.mt/important-information/
Address where the Programme will be Delivered	*MCAST has four campuses as follows:* **MCAST Main Campus** Triq Kordin, Paola, Malta *All courses except for courses delivered by the Institute for the Creative Arts, the Centre of Agriculture, Aquatics and Animal Sciences and the Gozo Campus are offered at the Main Campus address (above).* *Courses delivered by the Institute for the Creative Arts, the Centre of Agriculture, Aquatics and Animal Sciences, or the Gozo Campus, are offered in one of the following addresses as applicable:* **Institute for the Creative Arts** Mosta Campus Misraħ Għonoq Tarġa Gap, Mosta **Institute of Applied Sciences** Centre of Agriculture, Aquatics and Animal Sciences, Luqa Road, Qormi **Gozo Campus** J.F. De Chambray Street MCAST, Għajnsielem Gozo *In the case of courses delivered via Online Learning, students will be following the programme from their preferred location/address.* *Programmes delivered via Blended Learning, and which therefore contain both an online and a face to face component shall be delivered as follows:*

	○ Face to Face components – as per above address instructions ○ Online components – from the student's preferred address.
Course Description *(Refer to Programme Specification)*	The Master of Science in High Performance Buildings (HPB) gives candidates the opportunity to develop optimized building concepts, integrating various components of holistic design methodology, building physics, building climatology and comfort, energy-efficiency, environmental sources, building services systems, building aerodynamics, thermal and fluid dynamic CFD simulations, lighting design, building operations, as well as green urban modelling. The programme provides for advanced skills in specialization and scientific research of building physics coupled with architectural design, preparing students for professional as well as research and development settings at national and international levels. This course is not related to the Engineering Warrant. Fees: Fees apply - Further information through MG2I (MCAST Gateway to Industry)
Deskrizzjoni tal-Kors *(Refer to Programme Specification)*	Il-Master of Science in High Performance Buildings (HPB) jipprovdi lill-kandidati l-opportunità li jiżviluppaw kunċetti ta' bini aħjar milli għandna, billi jużaw elementi tal-metodoloġija ħolistika tad-disinn, tal-fiżika tal-bini, tal-klimatoloġija u l-kumdità tal-bini, tal-effiċjenza fl-enerġija, tas-sorsi ambjentali, tas-sistemi tas-servizzi tal-bini, tal-ajrudinamika tal-bini, ta' simulazzjonijiet dinamiċi (CFD) termali u fluwidi, tad-disinn tad-dwal, tal-operat tal-bini, kif ukoll tal-immudellar ekoloġiku urban. Il-programm jipprovdi ħiliet avvanzati fl-ispeċjalizzazzjoni u fir-riċerka xjentifika tal-fiżika tal-bini flimkien mad-disinn tal-arkitettura. Dan iħejji lill-istudenti għal ambjenti professjonali u ta' riċerka u żvilupp f'livelli nazzjonali u internazzjonali. Dan il-kors ma jagħtix id-dritt lill-kandidat għall-warrant ta' inġinier. MIŻATI: Japplikaw ħlasijiet - Aktar informazzjoni permezz ta' MG2i (MCAST Gateway to Industry
Career Opportunities:	-
Entry Requirements *(Refer to Prospectus / Course Page on MCAST website)*	Applicants must hold a recognised MQF/EQF Level 6 qualification, with at least 180 credits, in an Engineering or Scientific area. Applicants found eligible as per above, will also be asked to successfully complete a Master's Programnme Suitability Interview In the absence of above entry requirements, applicants aged 27 years and over, can submit an application under the Maturity Clause…. but must present a recognised MQF/EQF Level 5 qualification (at least 120 credits), or its equivalent, in an Engineering or Scientific area, together with clear evidence of a minimum of five (5) years (full time) direct and relevant experience. Applicants under Maturity Clause, will be asked to sit for a combined Maturity and Master's Suitability Interview
Other Notes related to this Programme, and which are to be taken note of	This Master's Programme MAY be available as Full-Time delivery, if this same programme will be taking off for an International Cohort. Fees apply as will be guided by MG2i (MCAST Gateway to Industry). Information about this Master's Programme being offered on a Part-Time delivery mode, can be found on the MG2i Website promoting such programmes - https://mg2imalta.com/.
Programme Learning Outcomes *(Refer to Programme Specification)*	At the end of the programme the students are able to; 1. Design holistically in order to unify passive and active building technology solutions and to integrate building into a larger context. 2. Responding to, and take advantage of, current environmental circumstances, potentials and synergies. 3. Integrate special aspects of HPB-related physics and design methods into the regular planning procedure. 4. Act as an interface between design participants in fields related to design and construction.

	5. Use the appropriate methodology to strengthen the dialogue between the various professional disciplines, coordinating them in accordance with desired HPB project goals.
Teaching, Learning and Assessment Procedures	The programmes offered are vocational in nature and entail both theoretical lectures delivered in classes as well as practical elements that are delivered in laboratories, workshops, salons, simulators as the module requirements dictate. Each module or unit entails a number of in person and/or online contact learning hours that are delivered by the lecturer or tutor directly (See also section 'Total Learning Hours). Access to all resources is provided to all registered students. These include study resources in paper or electronic format through the Library and Resource Centre as well as tools, software, equipment and machinery that are provided by the respective institutes depending on the requirements of the course or module. Students may however be required to provide consumable material for use during practical sessions and projects unless these are explicitly provided by the College. All Units of study are assessed throughout the academic year through continuous assessment using a variety of assessment tools. Coursework tasks are exclusively based on the Learning Outcomes and Grading Criteria as prescribed in the course specification. The Learning Outcomes and Grading Criteria are communicated to the Student via the coursework documentation. The method of assessment shall reflect the Level, credit points (ECTS) and the schedule of time-tabled/non-timetabled hours of learning of each study unit. A variety of assessment instruments, not solely Time Constrained Assignments/Exams, are used to gather and interpret evidence of Student competence toward pre-established grading criteria that are aligned to the learning outcomes of each unit of the programme of study. Grading criteria are assessed through a number of tasks, each task being assigned a number of marks. The number of grading criteria is included in the respective Programme Specification. The distribution of marks and assessment mode depends on the nature and objectives of the unit in question. Coursework shall normally be completed during the semester in which the Unit is delivered. Time-constrained assignments may be held between 8 am and 8 pm during the delivery period of a Unit, or at the end of the semester in which the Unit is completed. The dates are notified and published on the Institute notice boards or through other means of communication. Certain circumstances (such as but not limited to the COVID-19 pandemic) may lead Institutes and Centres to hold teaching and assessment remotely (online) as per MCAST QA Policy and Standard for Online Teaching, Learning and Assessment (Doc 020) available via link https://www.mcast.edu.mt/college-documents/ The Programme Regulations pertaining to this Programme's MQF/EQF level available at: link https://www.mcast.edu.mt/college-documents/, apply.
Grading System	All MCAST programmes adopt a Learner-centred approach through the focus on Learning Outcomes. The assessment of MCAST programmes is criterion-referenced and thus assessors are required to assess learners' evidence against a pre-

	determined set of Learning Outcomes and Assessment Criteria. For a student to be deemed to have successfully passed a unit, a minimum of 50% (grade D) must be achieved. All full time units are individually graded as follows: A* (90-100) A (80-89) B (70-79) C (60-69) D (50-59) Unsatisfactory work is graded as 'U'. Work-based learning units (where applicable) are graded on a Pass/Fail basis only. Some units which follow industry standards and regulations may also be graded on a Pass/Fail basis as per programme regulations referred below. Detailed information regarding the grading system may be found in the Programme Regulations pertaining to this programme's MQF/EQF Level available at: https://www.mcast.edu.mt/college-documents/ (Refer to DOC 003, 004 and 005)
Exit Point (where and as applicable)	Where a student will not make it to the Final Certification achievable from this Programme of Studies (as per Programme Regulations), one might wish to look into Exit Point possibilities as may be applicable to this programme for studies. Further information, is available at https://www.mcast.edu.mt/college-documents/, kindly refer to *DOC 077 Procedure for the processing of Claims for Certificates at Interim Exit Points.*
Contact details for Further Learning Opportunities	The MCAST Career Guidance Team, offers the service of qualified and experienced Career Advisers who will be very willing to discuss with potential applicants the course which best achieves one's career ambitions, as well as exploring one's education route, or similar. **MCAST Career Guidance** Tel: 2398 7135/6 Email: career.guidance@mcast.edu.mt
Regulatory Body/ Competent Authority Contact Details *(where applicable - in the case of a programme leading to Regulated Profession)*	Not Applicable

Programme Structure	Unit Code	Unit Title	ECTS	Year	Semester
	ETHPB-706-1801	High Performance Building (HPB) Design Approach	6	1	-
	ETHPB-706-1802	Building Climatology	6	1	-
	ETHPB-706-1803	Building Energy	6	1	-
	ETHPB-706-1804	Building Aerodynamics	6	1	-

	ETHPB-706-1805	Energy and Climate Dynamic Building Simulations	6	1	-
	ETHPB-706-1806	Aerodynamic Building Simulations	6	1	-
	ETHPB-706-1807	High-Performance High-Rise Buildings (HPHRB)	6	1	-
	ETHPB-706-1808	High Performance Settlements (HPS)	6	1	-
	ETHPB-706-1809	Project 1 – Building Design Project (HPB)	6	1	-
	ETHPB-706-1810	Project 2 – Settlement Design Project (HPS)	6	1	-
	CDDIS-730-1801	Dissertation	30	1	-

Allocation of Total Learning Hours (per Unit)	The total learning hours required for each unit or module are determined as follows:			
	Credits (ECTS)	**Indicative contact hours[1]**	**Self-Learning and Assessment Hours[3]**	**Total Student workload (hrs)[2]**
	1	5 – 10 hrs	20 - 15 hrs*	25 hrs
	2	10 – 20 hrs	40 - 30 hrs*	50 hrs
	3	15 – 30 hrs	60 - 45 hrs*	75 hrs
	4	20 – 40 hrs	80 - 60 hrs*	100 hrs
	6	30 – 60 hrs	120 - 90 hrs*	150 Hrs
	9	45 – 90 hrs	180 - 135 hrs*	225 hrs
	12	60 – 120 hrs	240 - 180 hrs*	300 hrs
	Note: The 'Self-Learning and Assessment Hours[3]' amount to the difference between the 'Indicative Contact Hours'[1] and the 'Total Student Workload'[2]			

APPENDIX 1

MINIMUM CREDITS FOR QUALIFICATIONS AT DIFFERENT LEVELS

MQF Level	Minimum ECTS Required for a Qualification*
8	
7	30
6	180
5	30
4	30
3	60
2	60
1	40

* Programmes assigned fewer ECTS than indicated will be classified as Awards.

Reference: Fig.1: p48, Malta Further and Higher Education Authority (MFHEA) (October 2024). Referencing Report, 5th Revised Edition.

APPENDIX 2

EXAMPLES OF QUALIFICATION TYPES AT A SPECIFIC MQF LEVEL

MQF Level	Examples of qualification types at a specific MQF level (The list in this column is not exhaustive)	Number of ECTS *
8	Doctoral Programmes:	
	PhD	N/A
	Professional Doctorate	180
7	Master's Degree	90
	Postgraduate Diploma	60
	Postgraduate Certificate	30
6	Bachelor's Degree	180
	Bachelor's Honours	240
5	Undergraduate Higher Diploma	90
	Undergraduate Diploma	60
	Undergraduate Certificate	30
	VET Level 5	60
4	Advanced Diploma	120
	Pre-Tertiary Certificate	30 - 60
	MATSEC Matriculation Certificate (Advanced and Intermediate)	N/A
	VET Level 4	120
3	Certificate	60
	MATSEC Secondary Education Certificate	N/A
	VET Level 3	60
2	Foundation Certificate	60
	MATSEC Secondary Education Certificate	N/A
	VET Level 2	60
1	Introductory Certificate	40
	VET Level 1	40

* Programmes assigned fewer ECTS than indicated will be classified as Awards.

Reference: Fig.2: p48, Malta Further and Higher Education Authority (MFHEA) (October 2024). Referencing Report, 5th Revised Edition.

ETHPB-706-1801: High Performance Building (HPB) Design Approach

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Without fundamental knowledge about basic holistic building design approach, elementary planning methodology and architectural theory, it is impossible to 'go on the right path' in order to develop HPBs. The critical issue is to clarify the most important terminology in the context of sustainable construction, as well as to examine vernacular building technologies in different climatic and geographical regions. Vernacular technologies are intended for new building design, as well as being applicable in refurbishment planning of the existing building substance. These are inevitable premises to continue with widespread professional studies of HPB.

The main aim is to deliver specialised theoretical basics in complex contemporary and historical sustainable architecture. Synergies in design strategies are taught, along with the most important special design aspects and techniques. Components of elementary HPB design methodology will be deepened in further thematic study units.

The content of this study unit focuses on contemporary architectural design extending new, innovative factors, which essentially modify current planning into a multi-dimensional design process. Natural science and engineering contents complement architecture (geometry, function, structure and aesthetics) with topics of external and internal climate, energy, envelope theory, materials, aerodynamics, low-tech and high-tech technologies, bionics, furthermore efficiency increasing synergy effects and quantification methods.

Basic theoretical knowledge and methodology of a sustainable, comfortable, healthy and energy conserving – respectively carbon harmonising – building industry.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Analyze methodologically building design philosophy;*
2. *Create a comprehensive building design approach and analyze it in different project settings;*
3. *Compare alternating sustainable building certification systems and assess them in terms of complexity, resolution, sincerity and importance;*
4. *Derive building typology as well as active and passive construction project strategies from efficient architecture history's influences;*
5. *Identify building physics 'driven' design aspects in the context of sustainability in terms of space organisation*
6. *Compare different design supporting tools;*
7. *Analyse and develop basic, theoretical HPB concepts in the early design stage;*
8. *Identify critical performance components in existing HPB building projects.*

ETHPB-706-1802: Building Climatology

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

The detailed understanding and analysis of complex building physics is inevitable and a fundamental prerequisite for designing buildings at high comfort and energy efficiency level.

External climate (weather) circumstances, as well as indoor climate (comfort) conditions are the most important determining impacts on buildings' design in terms of space creation, structures, materials, services (heat transfer and ventilation) systems and operation management.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Recognise the interaction between the external and internal climatic effect-mechanisms to determine building design;*
2. *Evaluate the effects and consequences of different climatic conditions and their impact on building design;*
3. *Use meteonorm to design construction systems in different climatic regions.*
4. *Evaluate internal climate criteria to create healthy and comfortable indoor environments;*
5. *Distinguish general from local thermal comfort variables and apply appropriate calculation methods and measurements;*
6. *Evaluate indoor air quality values of different buildings in different operation strategies.*

ETHPB-706-1803: Building Energy

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Malta's building energy regulations and legislation contents must be integrated in the curriculum with their most crucial, fundamental specific calculation methods. I need this material from Maltese building energy auditors or expert, since every member of the EU has to create its own definition of NZEBs (nearly zero energy buildings). In addition, in different countries, alternating national energy calculations are legislated and used for building energy qualification. Important to mention that the MCAST teaching staff should teach this part of the curriculum content, after participating in the training the trainers programme.

Approximately 50% of the world's primary energy need is caused by building industries' activities, including construction, operation and demolition/recycling. According to prognosis, by 2050 the global primary energy consumption will be doubled, concurrently long-term supply of energy cannot be covered by – in near future depleting - fossil sources. With the "20-20-20 initiative", the EU plans to reduce the level of energy consumption and CO_2-emission in 1999 by 20% and increase the renewable energy use and efficiency by 20% until 2020. The EU also proposes to reduce the carbon emission level of 1990 by 80-95% till 2050. The legislative regulation background continuously tightens provisions, e.g. the EPBD 2010/31/EU directive prescribes that in all EU member states by 2019 all new public buildings, and by 2021 all new buildings must be nearly zero energy buildings (NZEB).

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand buildings as holistic energy systems with a critical view in the analysis of building concepts and systems;*
2. *Evaluate interdependencies between architecture, climate, energy and HVAC systems in HPB design through understanding real, reliable and efficient interaction between 'house and machine';*
3. *Implement ideas and concepts of energy-efficient passive and active design solutions in building energy concepts;*
4. *Develop a building technology system concept;*
5. *Solve building energy related calculations in the field of heat load of air flow, heat loss by transmission, solar heat gain, inner heat load, heat storage, heating and cooling, ventilation and natural lighting;*
6. *Optimize building energy concepts through quantified feedback in decision-making process.*

ETHPB-706-1804: Building Aerodynamics

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Among thermal energy fluxes air flow phenomena are a deciding ‘member’ of heat distribution, heating and cooling effects due to thermal convection and wind induced fluid flow mechanisms. In addition, the air flow characteristics of buildings radically affect the indoor air quality, and as a result the level of hygienic ‘healthiness’ of buildings. Also in outdoor public spaces in cites and settlements comfort (wind climate), pollution and waste gas dispersion and space quality strongly depends on air flow systems in and around (between) buildings, - in one word: the aerodynamics of buildings.

Without understanding and implementing knowledge about aerophysics in building design, it is not possible to create high energy and climate performance built environment.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Use building aero-physical context and coherence systems in the development of theoretical high performance building ventilation concepts;*
2. *Optimise passive building ventilation system with special regard to high thermal and air quality comfort, utilizing low energy demand;*
3. *Solve critically steady-state, simplified comfort and energy calculations according to natural and mechanical ventilation in buildings;*
4. *Optimise energy and climate performance of HPB’s ventilation systems through simplified ventilation calculations.*

ETHPB-706-1805: Energy and Climate Dynamic Building Simulations

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Blended Learning
Total Learning Hours: 150

Unit Description

Energy, ecology and environment questions become increasing attention both in our general society, as well as in professional building industries. Closely related to this, comfort and energy performance questions are gaining more and more in importance, dealing with building climate behavioural and building physics characteristic. Until the mid-1960s only ‘hand’ calculations methods could determine time averaged (typically monthly resolution) values for estimating energy use in buildings. Since computational resources were limited and expensive, in heating demand calculations e.g. the degree-day method was commonly used, neglecting and simplifying important elements, such as solar and internal gains, infiltration rates, non-steady operation of HVAC systems and transient thermal storage in structure’s mass, user behaviour, respectively. Different building geometries, MEP components and their components however require very complicated and time intensive algorithm handling.

Moreover, it is paradox that today’s practice uses hand-calculated methods to quantify the actual, highly complex dynamic processes in our buildings. As a logical result, monthly resolution hand calculations usually don’t agree with measured values. Their monthly resolution should be shortened so long, until dynamic simulations resolution is reached. To sum it up, hand calculations are getting more and more complicated and time consuming solutions in contrast to dynamic simulations, which ensure hitherto unreached accuracy, high resolution and calculation velocity. While conventional hand calculations deliver approx. 50% of accuracy, triggering over dimensioning of HVAC systems and energy related structures (design uncertainty), dynamic calculations ensure approx. 95% accuracy, with exact dimensioned, cost-efficient technical system and structure dimensioning (certainty, design reliability).

Last but not at least, dynamic simulations make it possible receive a complete video film about the behaviour characteristic of a building I time dependency that gives the opportunity to design operation management and predict interdependency effects, which are – after a certain size and complexity of project - simply not possible to model with hand calculations anymore. Building dynamic simulations means planning in four dimensions (4D), catapulting high performance building development into the next level. Due to this simulation supported design technique, project dependently 50-80% savings in investment and operation expenses can be achieved in comparison to conventional design. Also, simulations represent today’s most developed and sophisticated methods to conduct research in building industries. Implemented, case study reference building's experiences and insights about thermal building dynamic simulations supported design process.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Implement theories of thermal building physics in simulation supported building design;*
2. *Use thermal dynamic building simulation tool(s) to determine preliminary boundary conditions, 3d modelling of spaces and structures, create HVAC systems and internal gains;*
3. *Evaluate and resolve problems in modelling and solver procedure;*
4. *Calculate heating and cooling loads, energy and custom, time dependent dynamics applying thermal simulation software;*
5. *Evaluate and assess simulation results in terms of building physics background theory, thermal and visual comfort, energy demand and consumption;*
6. *Optimize building envelope structures and basic conceptual hvac systems in terms of thermal efficiency;*
7. *Optimise HPB concepts and systems by working with simulations as design supportive feedback for machine and building development.*

ETHPB-706-1806: Aerodynamic Building Simulations

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Detailed, high-resolution calculations in the field of building aerodynamics are only possible applying fluid dynamics model experiments and numerical simulations, ensuring high-level of precision. In contrast, simplified aerodynamic calculations for natural ventilation, night cooling potential or wind effects on buildings cannot deliver design accuracy and planning certainty, as well as reliability at the level and quality of computational fluid dynamic (CFD) simulations.

Since air flow currents are not visible, humans cannot develop a correct intuition for understanding flow processes. Due to visualisation of CFD simulations (and/or wind tunnel tests) currents 'become' visible, making easy analysis and thus visual development of correct intuition without understanding of very complex mathematical models.

After basic understanding of simulation methods and proper viewing of results during this study unit, - as a next step – students have the opportunity to further develop their CFD skills in post study programmes (e.g. Ph.D.).

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Apply basic CFD simulations in simplified building projects with special regard to air flow systems, natural ventilation solutions and passive cooling effect;*
2. *Develop building aerodynamic knowledge and CFD simulation skills;*
3. *Interpret CFD simulations and adapt within design of real building contexts;*
4. *Contextualize CFD simulations in different building operation mechanisms.*

ETHPB-706-1807: High-Performance High-Rise Buildings (HPHRB)

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

The number of high-rise buildings (HRB) has increased for more efficient use of urban floor space areas without considering environmental and energy consequences. In addition, HRBs possess significantly more floors and floor space compared to regular building sizes.

As a result, in consequence, the material and energy consumption of a m^2 specific net floor space high-rise building is significantly higher in inefficiency than in regular building substance. On the other hand, nowadays population growth becoming exponential numbers: the PNUD (Program of the United Nations for the Development) estimates that 5 billion people will live in cities until 2030, whereas in 1950 30% of our population lived in urban areas, and in 2000 the proportion of settlement dwellers climbed to 47% and till 2030, it is projected to rise over 60%. Regarding the increase of land costs as well, it is inevitable for cities to go for vertical development.

HRBs enable to save cultivable land, to reduce traffic infrastructure need and according pollution emissions, as well to reduce energy consumption and carbon emissions due to less horizontal energy infrastructure losses. A next logical step seems to be the further elaboration of HRB design into, green systems with high sustainable performance: the ‘birth’ of high-performance high-rise buildings (HPHRB).

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Analyse critical theoretical issues about high-performance high-rise buildings and implement them in design;*
2. *Evaluate HPHRB solutions under different climate conditions with regards to building envelope and space organisation;*
3. *Analyse climate and energy concepts for HPHRBS for different seasonal operation periods;*
4. *Develop detailed concepts for research and development in the area of tall buildings.*

ETHPB-706-1808: High Performance Settlements (HPS)

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Blended Learning
Total Learning Hours: 150

Unit Description

Based on extreme growing population tendencies in settlements and urban neighbourhoods, handling of urban planning aspects is critical in respect to energy and environment optimised retrofitting of historical city cores, refurbishing and extending existing settlement residential, public, office and industry building district substances. Also development of new sustainable settlements is of prime importance, since the implementation of one green, high comfort and energy performance building contributes only ‘one water droplet’ amount of improvement in our society’s’ sustainability evolution, while creation of complete districts and cities represents the ‘ocean’ amount of advancement in our World’s green development.

Another reason occurs for devoting special attention to high performance settlement (HPS) design, namely the holistic character of high performance building design approach that requires extending the focus from single building on the larger context, on the connection of several buildings across districts to the level of urban context.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Identify sustainable development strategies in urban planning;*
2. *Estimate energy demand using statistical methods;*
3. *Develop settlement scaled energy supply and management concepts, based on energy situation and infrastructure analysis;*
4. *Compare and contrast different energy demand scenarios in urban planning and/ or urban renewal;*
5. *Develop comfortable high quality outdoor urban public spaces;*
6. *Analyze and recommend development procedures as urban planner, as evaluator or as a consulting design expert.*

ETHPB-706-1809- Project 1: Building Design Project (HPB)

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

To master the acquired methodical and instrumental competencies, the students finish their master course with two practical study units. The current study unit instructs students to summarise the acquired theoretical knowledge and practical competencies from previous study unit topics, and apply them in a building project design task.

Participants are already able to demonstrate HPB philosophy, planning methods and contents, as well as impact factors of complex building physics. Dependencies and synergies between site, neighbourhood, orientation, building function, geometry, structures and aesthetics, as well as building climate, comfort, energy, environmental questions and building services systems will be merged into a meaningful relationship. In addition, participants can apply design-supporting techniques, such as climate, comfort, energy and aerodynamics simulations.

The planning development will be carried out by teams, in order to practice interdisciplinary-like working environment, as well as to enable part time study participants to absolve a high performance building (HPB) project design in more deepened and detailed resolution, thus enhancing and mastering their building design skills.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Design and analyze innovative strategies for HPBS adopting sustainable strategies;*
2. *Implement holistic design philosophy and the theoretical methods and issues of complex building physics into HPB design;*
3. *Create scientific planning work, applying dynamic simulations tools and models in the field of thermodynamics, lighting and fluid mechanics;*
4. *Collaborate at multidisciplinary level building design concepts and strategies;*
5. *Propose and defend building design and operational strategies.*

ETHPB-706-1810- Project 2: Settlement Design Project (HPS)

Unit Level (MQF/EQF): 7
Credits: 6
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 150

Unit Description

To master the acquired methodical and instrumental competencies, the students finish their master course with two practical study units. Based on the nature of holistic, iterative planning approach, particular – second – exercise study unit widens the design scope and addresses the development task of a high performance settlement (HPS). This task gives students the opportunity to use the previously acquired theoretical knowledge and practical competencies in a project design task, with the main focus on study unit 8 -“High performance settlements (HPS)”.

Participants are already able to demonstrate HPB philosophy, planning methods and contents, as well as impact factors of complex building physics. Furthermore, participants can apply design-supporting techniques, such as climate, comfort, energy and aerodynamics simulations. Comprehension of gained knowledge handles the interdependencies and synergies between urban neighbourhood, building typology and aesthetics, as well as city climate, comfort, energy, environmental questions and settlement infrastructure and services systems will be considered into a meaningful relationship. The exercise will be developed in group work in order to practice interdisciplinary-like work, as well as to enable part time study participants to absolve a larger scaled HPS project design, thus enhancing and mastering their urban design skills.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Design and analyze innovative urban planning strategies for urban developments adopting sustainable strategies;*
2. *Implement holistic design philosophy and the theoretical methods and issues of complex building physics into high performance settlement design;*
3. *Create scientific planning work, applying dynamic simulations tools and models in the field of thermodynamics, lighting and fluid mechanics;*
4. *Collaborate at multidisciplinary level urban settlement design concepts and strategies;*
5. *Propose and defend urban planning design and operational strategies.*