ITECH
Integrative Technologies & Architectural Design Research

M.Sc. Programme, Faculty of Architecture and Urban Planning, University of Stuttgart

Coordinating Institutes:
ICD - Institute for Computational Design
Prof. AA Dipl.(Hons.) Arch. Achim Menges

ITKE - Institute of Building Structures and Structural Design
Prof. Dr.-Ing. Ján Knippers
The M.Sc. Programme Integrative Technologies & Architectural Design Research is a multidisciplinary, research-oriented, experiment-based programme shaped around contemporary aspects of the built environment and practice.

The goal of the ITECH programme is to prepare students from different disciplines for the continuing advancement of technological and computational processes in architecture, as they merge the fields of design, engineering, construction and natural sciences. Coupling an intensive, critical and analytical approach to computational design, simulation and fabrication, the ITECH programme is focused on challenging the design space boundaries of current architectural and engineering practice. It seeks to provoke a re-examination of techniques, practices and theories of design in relation to the fields of engineering, robotics, digital manufacturing, material science and biology.

The programme is open to students with a recognized Bachelor degree in architecture (or architectural science), urban planning, civil engineering, biology or biomimetics, environmental engineering or similar engineering or natural science degrees. All program courses are instructed in English.

The programme is structured as a 2 year professional masters degree for students with a 3 year bachelor degree. However, students with a suitable 4 years bachelors degree or students who already hold a masters degree may apply for advanced standing – subject to the review by the university. Such applicants will be considered for placement on the third semester of the programme.

As the German university system offers free education, there are no tuition fees for both German and international students studying in the ITECH M.Sc. programme.
AGENDA – Why ITECH?

Technological progress has always been a catalyst for design innovation in architecture. Today, technological advancements across multiple disciplines suggest a profound transformation of the way the future built environment is conceived, designed and materialized. The increasing ubiquity of computational processes, the erosion of established disciplinary hierarchies of design and the rapid change of industrial logics of production has forged new alliances between the fields of design, engineering and natural sciences, leading to novel multidisciplinary and multifaceted design cultures. Design plays a critical role in this transformation: Here, the notion of design is extended beyond the design of space, surface and structure to the design of processes, systems and reciprocities.

The masters programme investigates the realm of integrative technological advancements as novel tectonic, spatial, structural, aesthetic and ecological potentials in architecture. It seeks to prepare students for the complex contemporary conditions of architecture, which is facing ever more stringent environmental and economic challenges while at the same time experiencing the emergence of new technical opportunities at an unprecedented speed. Thus, the master programme is inquiry-oriented, experiment-based and shaped around contemporary aspects of design research. Students will engage with the integration of cutting-edge computational architectural design, structural and climate engineering as well as advanced fabrication and construction technologies. The interrelation of such topics will be exposed as both a technical and intellectual venture. The programme encourages a conjoining conception of technological progress, design innovation and cultural production, emphasizing rigorous investigation, creative engagement and critical reflection on the implications and potentials of technological innovation for architectural design.

Examples of the long-standing teaching and research collaboration of the coordinating institutes include the ICD/ITKE Research Pavilions and various other projects.
TEAM – Who we are!

The M.Sc. Programme Integrative Technologies & Architectural Design Research is coordinated by the ICD Institute for Computational Design and the ITKE Institute of Building Structures and Structural Design in collaboration with the IBK2 Institute of Building Structures.

ICD - The Institute for Computational Design (link) provides expertise in advanced design computation and robotic fabrication as it pertains to architecture. The ICD’s researchers have studied in world class schools of architecture and/or have worked for leading architectural practices. Prof. Achim Menges is internationally renowned for his design work and research, with visiting professorships at both Harvard University and the Architectural Association.

ITKE - The Institute of Building Structures and Structural Design (link) is focused on research in highly efficient structures and new materials for architecture. The multidisciplinary team of ITKE research associates brings together competences from various fields of advanced building technologies. Prof. Jan Knippers is author of numerous books and publications, as well as partner in an international engineering firm collaborating with renowned architects around the globe.

The multidisciplinary and research-oriented character of the ITECH programme has been developed to provide students with the opportunity to take full benefit of the larger, international network of interdisciplinary research and expertise available through the partner institutes, the university and its related external-industry collaborators. The programme has the unique advantage of being situated within the heartland of technological innovation in Germany; the ITECH programme is aimed at furthering the long-standing relationship with industry networks that the partner institutes have established.

The university as a whole is recognized internationally for its education and research in technology and garners significant research funds in a vast array of fields for technology and design. The Faculty of Architecture consistently ranks among the top schools in Germany, and is also supported by extensive research through both private industry and publicly funded projects. The University of Stuttgart is also renowned for creatively engaging the rigour and insights of engineering science in architectural design. This high level of research exposure is reflected directly in the quality of the school’s faculty and curriculum.
CONTENT – What to expect?

The programme offers the opportunity to study with one of the leading teams for technological and computational design research, and as a team, the partner institutes strive to present students with a cutting-edge educational experience that fosters the development of the students own individual interests in architectural design, structures, technology and computation.

The programme is centred on the integrative format of Design Research Projects and a Master Thesis. The projects take advantage of the extensive collaboration among the partner institutes and are supported by a diverse range of Supplementary Modules, and Expert Colloquiums, offered by both institutes. The supplementary modules provide the technical and conceptual foundation necessary for the successful development of Research Projects while allowing students to explore individual areas of interest.

The main fields of investigation for the Design Research Projects include:

- Morphogenetic computational design processes.
- Bottom-up design and engineering of material systems and hybrid structures.
- Investigation of novel production paradigms enabled by robotics and generative manufacturing.
- Integration of biomimetic strategies for the design and engineering of performance-oriented architectural morphology and ecologically embedded architectural physiology.
- Exploration of novel architectural tectonics and related performance capacities.
- Integrative testing through full-scale prototypes and mock-ups.

Supporting seminar modules expose students to the following topics:

Computational Design
- Contextual analysis of contemporary computational design cultures. Research on theoretical and professional implications of a computationally driven paradigm shift, precedent research work and significant projects.
- Development and implementation of advanced computational design techniques for architecture. Design oriented data and geometry management: Algorithmic procedures, evolutionary computation, agent based modelling, parametric modelling, simulation and their supporting programming language (visual programming, software specific scripting, Python, Java, etc.).

- Computational and computer-aided methodologies for integrative design, manufacturing and fabrication strategies. Machine-specific constraint space modelling, feedback techniques, automated control language, production simulation, prototyping and related computational tools for advanced manufacturing and robotic fabrication.

Structural Design
- Form-finding of hybrid structures.
- Computational and physical form-finding strategies for form- and surface active lightweight structures.
- Simulation technologies and computational optimization
  Basic knowledge of Finite Element Methods, evolutionary optimization strategies and their integration in computational design processes.
- Characterization and testing of materials
  Specification of mechanical, energetic and ecological properties of materials, development of multifunctional composite materials and exploration of their architectural and structural potentials, methods of material testing in theory and practice.

Building Construction:
- Building systems
  Advanced knowledge of technical principles for sustainable and resource efficient building design and construction emphasizing the interrelations between building structure, building envelope and building technologies.
- Building envelopes
  Advanced theoretical and practical knowledge of the building envelope and its requirements, and in the design development of complex building skins, regarding materials and components, basic knowledge of building physics, adaptive systems for building envelopes.

Biomimetics:
- Introduction to interdisciplinary research methods and knowledge transfer in collaboration with biologists.
- Introduction to biomimetic design strategies including bottom-up / top-down approaches and product- / process-orientation, as well as introduction to precedent projects and research.

Expert Colloquium
- In addition to the previous modules, the Expert Colloquium is presented as a flexible format academic experience directed by one or several leading guest researchers and supported by the partner institutes. The intent of the colloquium is to bring interdisciplinary expertise from external cutting edge researchers into the programme through a flexible academic format. The specific schedule, contents and format of each colloquium will be announced during the corresponding academic semester.
RESOURCES

In addition to the centrally located studio space in the downtown campus, the ITECH programme offers access to both the specialized resources of the partner institutes, as well as the extensive resources of the Faculty of Architecture and the University of Stuttgart as a whole. These resources include:

- Robotic Laboratory (RoboLab, 6-axis KUKA KR 125/2 industrial robot and a vertical turntable as 7th external-axis)
- Material Testing Laboratory (various testing facilities for static and dynamic loading up to 400kN)
- Model Shop (three laser cutters, one cutting plotter and two 3-axis CNC milling machines)
- Computer Laboratory (Casino IT, Faculty of Architecture computer laboratory, 3D printer and plot service)
- Wood Shop, Metal Shop
- Photography Studio
**PROGRAMME STRUCTURE**

The M.Sc. Programme *Integrative Technologies and Architectural Design Research* is research-oriented, multidisciplinary, international and thus taught in English.

The programme is open to students with a previous Bachelor degree in one of the following qualifying fields:

- architecture
- urban planning
- civil engineering
- biology or bionics
- environmental engineering
- or similar engineering or natural science degrees

The programme leads to an internationally accredited Masters degree and is offered as a two-year full time programme (equivalent to 120 ECTS), with the possibility for advanced placement to the second year of studies for eligible candidates:

- Students who have completed at least a 3 year Bachelor Programme (equivalent to a minimum of 180 ECTS) that is internationally recognized and accredited. For students with a Bachelor degree in architecture the completion of the full two year M.Sc. Programme (120 ECTS) provides an internationally accredited professional degree in architecture.

- Students who have completed at least a 4 year Bachelor or Master Programme (equivalent to a minimum of 240 ECTS) are eligible to apply for advanced standing based on their ability to provide proof of equivalent credits of up to 60 ECTS. These credits must be from courses that are part of their previous education, and that are equivalent to modules offered as part of the first year curriculum of the ITECH programme.

(What are ECTS? European Credit Transfer and Accumulation System (ECTS) is an European standard for comparing study attainment credits. One academic year requires 60 ECTS credits, which is equivalent to 1800 hours of study. One ECTS credit is equivalent to 30 hours of study.)

Admission with Advanced Standing: Students who have completed a 4 years bachelors degree or students who already hold a masters degree in a qualifying field may apply for advanced standing into the ITECH programme. Such applicants will be considered for placement in the third semester of the programme - conditional on a review by the involved institutes - thus reducing the required course study to one year. Applicants will initially be offered acceptance to the first semester but they will also be notified of their advance standing eligibility; upon admission to the programme the advanced standing application will take place. Please note, that advanced standing applicants might receive advanced standing on some or none of the course credits based on the committee’s assessment. Equivalent credits must be analogous to the course of study of the first year of the ITECH programme curriculum and must also demonstrate high level of academic performance and design proficiency.

Please note: Due to the professionally accredited status of the programme, all international applicant’s degrees will undergo an equivalence check to confirm eligibility within the German academic system.

Students holding degree qualifications that differ from the list provided above will be assessed on an individual basis.

[below: ICD/ITKE Research Pavilion 2011. © ICD/ITKE University of Stuttgart.]
CURRICULUM

The curriculum is based on the German semester system: the winter semester typically takes place between mid October and mid February with a two week Christmas break, while the summer semester takes place between mid April and mid July. It is important to note that this is a full-time programme and course work and studio submissions may also take place outside the semester times.

First Year – During this first year, the curriculum is led by two Design Research Projects that are developed as a collaborative undertaking between the involved institutes. The introduction to relevant topics in computational design, engineering and construction is provided through two supplementary Seminar Modules per semester. In addition, a series of regular colloquia will expose the students to presentations in cutting edge research by leading experts in the related fields. Both, seminar modules and expert colloquia are structured to provide relevant support for the project development.

Second Year – The third semester is aimed at laying the foundation for a promising master’s thesis through a Thesis Preparation Project. This main module is supported by two Supplementary Seminar Modules and an elective 3 ECTS course of particular relevance for the planned research thesis. The entire fourth semester is dedicated to the development of the Master Thesis.

The ECTS structure of the programme is equivalent to the faculty’s general master programme Architecture and Urban Planning. This offers students the additional possibility to also attend courses at some of the other renowned institutes at the Faculty of Architecture.
**CURRICULUM**

**MODULES**

**Master Thesis Module (30 ECTS)**
  (Module No. 11600900)

**Project/Design Studio Modules (15 ECTS)**
- Integrative Technologies and Architectural Design Research Project 1.  
  (Module No. 11600801)
- Integrative Technologies and Architectural Design Research Project 2.  
  (Module No. 011300802)
- Integrative Technologies and Architectural Design Research Thesis Preparation Project.  
  (Module No. 011300805)

**Seminar Modules (6 ECTS)**
- Computational Design  
  (Module No. 11600601)
- Computational Design and Digital Fabrication  
  (Module No. 11600602)
- Form Finding  
  (Module No. 011300 601)
- Material and Structure  
  (Module No. 011300 602)
- Building Envelopes  
  (Module No. 010220601)
- Building Systems  
  (Module No. 010220602)
- Computational Design and Simulation  
  (Module No. 11600901)
- Architectural Biomimetics  
  (Module No. 011300605)

**Colloquia Modules (3 ECTS)**
- Expert Colloquium 1  
  (Module No. 011300701)
- Expert Colloquium 2  
  (Module No. 11600701)
- Thesis Preparation Module  
  (Module No. 11600705)

**5th Semester**
- Integrative Technologies and Architectural Design Research Project 3  
  (Module No. 11600803)

**6th Semester**
- Integrative Technologies and Architectural Design Research Thesis Preparation Project  
  (Module No. 011300805)

**Advanced Placement**
- Seminar Module  
  (Module No. 011300701)
- Seminar Module  
  (Module No. 11600701)

**30 ECTS**

**30 ECTS**

**60 ECTS**

**total: 120 ECTS**
APPLICATION – How to join?

In order to apply for the ITECH M.Sc. programme (winter semester 2013-14, starting on 14 October 2013) please submit the following materials by 15 May 2013.

(Please note: This deadline applies only for the intake in October 2013. The application deadline for studies commencing in October 2014 will be 15 February 2014.)

The application process includes the following steps:

Step 1: Online application
In order to apply for admission to the Masters programme in winter semester 2013/2014 you need to submit a full set of the required application documents (see below) to the online application portal no later than 15 May 2013.

Step 2: Pre-selection and interviews
If you have passed the pre-selection stage, you will be interviewed by two members of the selection committee. This interview may be a face-to-face or a telephone/Skype interview. For the intake in winter semester 2013/2014 interviews will take place at the beginning of June 2013. Please make sure your application documents contain an up-to-date telephone number and an email address as we will have to contact you in order to make an appointment for the interview. If we cannot contact you we will not be able to consider your application further.

Step 3: Selection, submission of hard copy documents, scholarships
The final selection will take place at the end of June 2013. You will be informed of the results as soon as the decision has been made. If selected to the ITECH M.Sc. Programme, hard copy of all of your documents is required. Please make sure to have all the documents ready for timely hard copy submission.

Important: Students currently studying in the final year of a Bachelor programme can apply for a conditional acceptance to the programme. However, for the admission to the programme the completion of the Bachelor degree is required.

Please note: The dates mentioned above are relevant for the coming winter semester 2013/2014 only. The dates will change for the following application terms. Please refer to this website for regular updates.
APPLICATION DOCUMENTS

In order to apply for the ITECH M.Sc. programme please submit the following material:

1. Application forms
   • application form University of Stuttgart
     (download here)

   >> Complete the form and save as PDF Format, max. 500KB file size.

2. Copies of qualifications and passport
   • copy of your school-leaving certificate (general qualification for university entrance certificate, high school certificate, diploma or equivalent)
   • copy of your university transcript
   • copy of your university degree diploma

   Please note: The copies of these documents need to be officially authenticated and English or German translations are required.

   • proof of your English proficiency: IELTS (band 6) certificate or TOEFL (minimum score: 550 paper based, 213 computer based, 79 internet based).

   Please note: If an applicant’s first language is English or his/her university studies have been conducted in English, written confirmation of English proficiency from the university can be sent instead.

   • copy of your passport (optional but recommended)

   >> Scan documents and save them in PDF Format, max. 500KB file size each.

3. Your motivation, professional and academic experience documents.
   • Curriculum Vitae (CV) (optional but recommended).
   • Letter of motivation (one A4 page maximum) stating your interest for applying to this specific programme.
   • Portfolio: The portfolio should include work samples relevant to this master programme as well as the Bachelor degree work. If you are still studying in the final year your Bachelor programme and thus apply for a conditional acceptance to the programme, please provide an alternative work sample. Students with a previous degree in engineering or natural sciences should provide work samples including a short summary of their bachelor’s thesis. The portfolio / work samples should be submitted as one

PDF document: maximum 10 pages, format DIN A4, maximum file size 5 MB.

>> Save documents in PDF Format, max. 500 KB file size. The portfolio may be up to 5 MB.

Important: Please compile all documents into a single PDF with a maximum file size of 10MB. The naming convention for the file is:

2013_LASTNAME_FIRSTNAME_ITECH.pdf

Submission
Please send the compiled PDF document (max. 10MB, 2013_LASTNAME_FIRSTNAME_ITECH.pdf) to the following email address:

itech@icd.uni-stuttgart.de

Only if you receive conditional acceptance to the M.Sc. programme, will you be required to submit a complete hard copy version of all the required hard copy documents. We advise candidates to start preparing their documents in advance.

COST

Tuition Fees
For both German and international students there are no tuition fees for studying in the M.Sc. programme Integrative Technologies and Architectural Design Research at University of Stuttgart. A registration fee of 138 EUR per semester is required.

Additional Programme Costs
Additional living and out of pocket expenses for academic tours, travel, software, materials, equipment use and other related expenses should be expected.

Living Expenses
For additional information on living costs in Germany (insurance, accommodation, etc) please see the International Affairs website of the University of Stuttgart (link)

The M.Sc. Programme Integrative Technologies & Architectural Design Research at the University of Stuttgart is still subject to the approval by the Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg. Approval is expected shortly.
FAQs

Q: When is the application submission deadline?
A: The application deadline for the upcoming winter semester 2013 (Starting 14 October, 2013) is scheduled to be 15 May, 2013.

Q: When is the notification for acceptance?
A: Notifications of acceptance will be issued early July 2013.

Q: Where can the application forms be found?
A: Please refer to the ICD and the ITKE website at: [link]

Q: What are the eligibility criteria?
A: Admission to the programme will be based on the mandatory completion of a Bachelor’s degree (or equivalent), examples of your previous work in the form of a portfolio, as well as your motivation letter. You may apply prior to finishing your degree, though acceptance to the programme will be contingent upon the completion of the degree prior to the start of the Master’s programme.

Q: What are the language requirements?
A: The programme will be exclusively taught in English. However, for international students who consider taking some basic German language courses, some initial language courses will be offered through the University of Stuttgart International Office. See info here [link].

Q: What are the portfolio requirements?
A: The recommended contents of the portfolio are: a list of projects (student projects, professional projects) relevant for course content; written description and graphic illustration of selected projects in terms of their content and relevance for the programme. The file size of the portfolio should not exceed 10 MB.

Q: Do I have to submit hard-copies of the application material?
A: You will initially have to submit your complete application package online (See “Application – How to Join ” section). However, acceptance to the ITECH M.Sc. Programme, will be conditional on the on-time submission of all certificates and related documents in hard copy.

Q: Is the M.Sc. programme registered with the Architecture Board in Germany? Does it qualify a graduate to be able to apply for a license with the Architects Registration Board or its equivalent German body?
A: The ITECH programme is currently pursuing the recognition through the Chamber of Architects in Germany (and is expected to be recognized by mid Summer 2013), so that the programme will provide a suitable basis for students with a previous degree in architecture to pursue professional Architecture licensing with the respective German Chamber of Architects. Please note that the completion of a mandatory 2-year practical experience, possibly an individual degree assessment and other prerequisites are required for all graduates by the Chamber of Architects before being able to apply for a license.

Q: What are the research prospects after the MSc degree?
A: The ITECH programme is aimed at providing students with the tools, research foundation and practical technical experience to pursue a wide range of professional roles in cutting edge research, engineering and design. Graduates will be very well suited to undertake professional roles in advanced architecture and engineering offices, advanced research and development institutes, or other related industries. Additionally, the ITECH programme will also be an ideal foundation to pursue further doctoral studies through one of the partner institutes.

Q: Will there be a boarding availability for international students?
A: There are student dormitories on campus and in Stuttgart-Vaihingen, however, it is up to each individual student to apply for accommodations. You can find information in both English and German through the International Office [link]. Additionally, the city of Stuttgart also provides attractive renting options in and around the city center. In either case, students must try to secure accommodations in advance- a few months prior to your arrival- as there is generally high demand for accommodations, particular during the late months of summer.

Q: What will be expected expenses to account for living, lodging, education materials, research trips, etc.? 
A: In order to calculate your monthly expenses you will have to take into account the cost of living, lodging, trips and course-specific study materials. Some support is often provided by the University for costs of travel related to a Design Studio or Seminar, such as a field trip or manufacturer visit. A general guide to student living cost in Stuttgart can also be found with the International Office.

Q: Are there recommendations for scholarships and grants?
A: For foreign students wishing to study in Germany, a good starting point is the website of the DAAD – German Academic Exchange Service [link].

Q: How many students will be admitted in total and how many will be able to do their Master’s through the ITECH programme?
A: On our first year, we are hoping to recruit a talented and multidisciplinary group of 15 – 20 students.

Contact
Email: itech@icd.uni-stuttgart.de

Web resources:
University of Stuttgart, Study Programmes [link] (De./Eng.)
International Affairs office- University of Stuttgart [link] (Eng.)
ICD- Institute for Computational Design [link] (Eng.)
ITKE - Institute for Building Structures and Structural Design [link] (De./Eng.)
Study Programs- University of Stuttgart [link] (De./Eng.)
M.Sc. Architecture and Urban Planing- University of Stuttgart [link] (De.)
Application Forms for Masters Programs- University of Stuttgart [link] (Eng.)
FAQ online application- University of Stuttgart [link] (De.)