POLITECNICO DI MILANO

PhD School of Politecnico di Milano

Regulations of the PhD Program in:
Architecture, Built Environment and Construction Engineering

XXIX Cycle

Campus: Milano Leonardo
(Approved by the ABC-PhD Program Board the 7th of May 2013)

1. General Information

PhD School of Politecnico di Milano
PhD Program: Architecture, Built Environment and Construction Engineering
Official Languages: English/Italian
PhD Program campus: Milano Leonardo
PhD School Website: http://www.ricerca.polimi.it/phd
PhD Program Website: http://www.abc.polimi.it/dottorato/

2. General presentation

ABC-PhD Program has been established in 2012, following the complete reorganization of the area of *Architecture, Built Environment and Construction Engineering* in one only Department. It results as merge of the following four PhD Programs:

- *Architectural Composition*
- *Building Engineering*
- *Design and Technologies Exploitation for the Cultural Heritage*
- *Technology and Design for Environment and Building*

These four programs have been partly joined by a group of researchers from a fifth one: the *PhD Program* in Structural Seismic and Geotechnical Engineering.
All these Programs have been active separately, since 1990, mainly focussing on one only discipline.
Their merge was aimed at optimizing the capability of the Department in training new researcher to face and solve complex research needs, with a single organizational unit.

3. Mission and vision

The general aim of any PhD Program is the training of *future researchers*. PhD Students must be able:

- To face complex questions, in complex contexts.
- To develop in-depth analysis and reliable models (theories) of the analysed systems (physical, economic, environmental or social).
- To innovate: concepts, products and their use, rules and organisations …

These skills are proven realizing an original study (the *PhD thesis*) whose value corresponds to its contribution to the advancement of the knowledge about a specific *Research theme*.

The ***mission*** of ABC-PhD Program is *to train researchers and experts* in the fundamental fields of *Architecture*, *Built Environment* and *Construction Engineering*, endowed with:

- High-level scientific knowledge.
- Significant experience in *Research and Development* (R&D) activities.
- Proven communication and management skills.

These *fundamental fields* will be defined in coherence with international research activities and the Department strategic themes:

- Advanced Materials and Innovative Systems for Buildings
- Design and Technologies for the Energy-Efficient and Sustainable Built Environment
- Seismic and Fire Safety of buildings, infrastructures and construction sites
- Architectural Design and Urban Design
- Complex Buildings Design, Construction and Management
- Preservation, Valorisation and Promotion of Built Heritage
- ICT and Smart Systems in Construction and Planning
- Built Environment Economics and Management

Moreover, ABC-PhD Program aims to work as a fundamental wheel of a chain drive system between the Department – and the world of research in general – and other non-academic entities, activating a continuous *knowledge transfer* toward them and giving back to Academy the great value of a reason to research.

Our ***vision*** wishes:

- Our *students* to become self-sufficient, independent "actors", able to gain – as *scientist*, as *intellectuals*, as *professionals* or as *entrepreneurs* – an outstanding position at an international level.
- Our *PhD Program* to become – in few years – the *Italian Point of Reference* for training experts in all the most critical subjects related to the sustainable transformation and management of the Built Environment (environmental, economical, social and cultural sustainability), viewed as "ecosystem".

4. Professional opportunities and employment market

The *ABC-PhD Program* is structured with a strong relationship with the homonymous Department of *Architecture, Built Environment and Construction Engineering* and, through it, with the Schools of Architecture, Civil and Building Engineering served by the Department. Moreover, the habit of communicating and working in English, as well as the knowledge of the academic world, acquired during visits and stays abroad, qualifies the Doctorate for positions offered by the best international universities and research centres. With this aim, the three years of study and participation to the research activity of the Department (and of its joint foreign institutions) will also offer students the following opportunities:

1. to take part to effective "knowledge transfer" processes;
2. to enter in contact with private companies and public bodies;
3. to face societal needs.

This will **provide the best occupational opportunities** for a researcher looking for an academic career as well as for an employment in research centres, architectural and engineering design enterprises, public bodies or private societies that need highly qualified personnel.
The ABC-PhDoctorate is expected become an *international investigator* able to shoulder responsibilities of R&D activities, the planning and management of control activities and the critical assessment of any policy

and project concerning built environment and built asset, for public and private bodies. He/she is also expected to become:

- an estimated Professional, operating in engineering and architectural firms as designer or as independent actor;
- a Project or Construction Manager or a Facility Manager, for Construction Industry, Real Estate and Asset Management;
- an independent consultant able to develop criticality analysis of any built environment transformation at a strategic as well as detail level.

5. Enrolment in the ABC-PhD Program

5.1 Admission requirements

Graduated Italian and foreign citizens may apply, and with a good **English Language proficiency**:

- For what concerns **graduation level**, *Candidate PhD Students* are required to be graduated in accordance with the pre-existing laws DM 3.11.1999 n. 509 or to have a master of science degree in accordance with DM 3.11.1999 n. 509 or a master of science in accordance with DM 22.10.2004 n. 270 or similar academic qualification obtained abroad, equivalent in duration and content to the Italian qualification and for an overall duration of university studies of at least five years.
- For what concerns the **English Language Proficiency** the level required is, at least, B2.

Admission to the Program will be decided according to evaluation of the Curriculum Vitae of the *Candidate PhD Student*, cover letters and the *PhD Research Program* proposed by the same candidate, all submitted together with their application and in reply to the admission call. The admission procedure may include oral discussion, which can take place either in person or via computer.

5.2 Admission deadlines and number of vacancies

The number of vacancies is indicated in the call for admission to the 29th PhD Program cycle: http://www.polimi.it/phd and http://www.ricerca.polimi.it/index.php?id=4731.
Scholarships both on general and on specific themes are available, in accordance with what is specified in the call for admission. Up to 30 positions are available. Positions may be covered by scholarships granted from the University and Research Ministry, from Politecnico, from companies or from the Department, based on research project funds.

6. PhD Program Contents

6.1 The *Research Topic,* the *Tutor*, the *Supervisor* and the *Reviewer*

The *PhD Program Board* will assign a (tentative) **Research Topic** to each *PhD Candidate* admitted to the Program and it will appoint a **Tutor**, for each one of them.
The *Tutor* is chosen among the members of the PhD Program Board, with the following assignment:

- To refine – together with the PhD Student – the definition of his/her *Research Topic*.

- To monitor, supervise and support the PhD Student in planning and the developing his/her activity.

He periodically refers, with a written report to the *PhD Program Board*, about the attainment of Student's objectives and the quality of his/her work.
Once the Student has reasonably detailed the subject of his/her *PhD Thesis* and completed his/her competencies and skills, the *PhD Program Board* will appoint a **Supervisor** who will guide and support the Student in the development of his/her research activities related to the thesis.
Eventually, at the end of the third year – or before, if needed – the *PhD Program Board* will appoint one or more external **Reviewer** to evaluate PhD Student's work and Thesis.

6.2 The *Training Program*

The activity of *ABC-PhD Students* will focus on the assigned *Research Topic* and will have the following general aims:

- To complete their *skills* and to enhance their *competencies* in the specific *Research Area.*
- To develop their *research-oriented mindset* and to improve their *problem-solving aptitude*, with a particular care to multidisciplinary and systemic approach.
- To acquire the *capability to present* their work, discussing and defending it.
- To induce them *to realize advancements* on a specific *Research Topic*, i.e. to find *original solutions* for a theoretical or practical problem and to show their *trustworthiness* or *feasibility*.

To support the attainment of these *general aims*, the ABC-PhD Program will offer *educational opportunities* (see. Par. 6.4) to its Students, encourage them to attend specific courses, and promote their studies and participation to selected *Research Activities*, managed or just supervised by ABC Department researchers, also in collaboration with other International Research Centres and Universities.
Every activity will be carefully planned in the Student's personal **Training Program** that will be proposed by the same *Student* and endorsed by his/her *Tutor*.

This Program will schedule, for **three years of full-time work**, this kind of training activities:

- *Educational Activities*: courses and studies needed to complete and to refine Student's skills, propaedeutic to the analysis of the *Research Topic*. In particular, the Program will schedule courses for a minimum of 30:
    - at least 5 ECTS Credits must be acquired attending courses offered by the PhD School.
    - at least 10 ECTS Credits, attending Multidisciplinary courses offered by ABC-PhD Program.
- *Research Activities*: the development of the PhD Thesis and the participation to specific research activities, related to the *Research Topic*, if suitable to gain experience in research planning, management and execution, as well as in knowledge transfer practice or for a particular occurrence.
- *Communication Activities*: writing and publishing the research results of the Student, in international peer-reviewed journals and conferences proceedings, and, in general, his/her active participation to international research symposiums.
- *Teaching activities*: PhD Students may include Teaching activities about their PhD Thesis topics, which will be acknowledged as knowledge transfer activities, (max 5 ECTS), in their whole program.

Educational and teaching activities must sum up to a maximum of 60 ECTS.

Fig. 1 and 2. Schematization of two possible Training Programs. The first table shows a program for the maximum amount of Educational Activity (60 ECTS), the second, a program for the miminum. Also the metric of Research, Communication and Teaching activities is in ECTS. No teaching activity is identified.

The training activities will be progressively organized, from introductory meetings and lessons (i.e. with older PhD Candidates or other research experts) to the PhD Thesis writing, and will be developed in the following way:

- In the *first semester*, the activity of each student will be dedicated to the definition of a State of the Art of his/her *Research Area*.
- The whole *first year* will be dedicated to the coverage of basic training needs of the Student, with the attendance PhD courses, and to the *final clarification* of the *Research Topic*.
- The second year will be dedicated to the organization of the *PhD Thesis work* and the completion of Student's skills and knowledge to support the achievement of PhD Thesis objectives.
- The third year constitutes the most intense period of *autonomous and original research work* and the elaboration of the PhD Thesis.

Tutors will encourage their students to carry out their Training Program in strict contact with other research groups, in other Universities and Research Institution.
On the other hand, each Candidate is expected to plan and organize – as part of her/his *Training Program* – a period of work and stay with one – or more – of these groups, preferably a foreign one, for no shorter than *six months,* in order to become more confident with the most wide international research community. The host of the Student may be another University or any other institution or private company engaged in high level research about the Student's Research Topic. Nevertheless, at least a half of the whole PhD period (18 months) must be developed at Politecnico di Milano.

6.3 Courses offered by ABC-PhD Program

The ABC-PhD Program and the PhD School will offer various courses especially for their PhD Students. These courses will aim at:

- Completing the skills and particular knowledge of the PhD Student;
- Examining basic research issues (general problems, theories, research methods and analytical tools, research management and valuing)
- Representing the cornerstone of the various fields of the ABC-PhD Program, identifying cultural positions and introducing them to specific cultural contexts.
- Exploring certain, specific Research Topics.

Courses are offered in English, unless otherwise provided. ABC-PhD Program, nevertheless, will always offer a Training Program entirely in English to the Student who requests it.

In the attached tables a list of the courses suggested for the ABC – PhD Program is presented. The titles and the responsibility of the courses are subjected to modification as well as their scheduling.

6.4 Approval, overview and control of the results of the Training Program

The personal **Training Program** will be proposed by the same *Student*, endorsed by his/her *Tutor* and approved by *PhD Program Board*, overviewing its coherence with the *Research Topic* and with the general aims of the *PhD Program*, as specified in chapter 6.2. A new approval is requested for any substantial change of the *Training Program*. This need will be monitored by Student's Tutor.

As the PhD Program is a **full-time work**, the Board must be informed about (and approve, in advance) every significant activity of every Student, also if she/he has not any kind of scholarship and if these activities will be not listed in the Training Program.

The *PhD Program Board* will periodically meet each Student in public meetings, to monitor his/her advancements, results and plans. The Student will be asked to submit:

- The revised *Training Program*.
- An updated *Report about Student's Studies and Courses*, endorsed by Candidate's *Tutor* and *Supervisor* (if appointed as different subject).
- An upgraded copy of Candidate's Scientific Production.

The Student's Tutor will be asked to submit a synthetic written evaluation of Candidate's activity.
The *PhD Program Board* may appoint its reviewing task to a Board Member. If no Board Member is available, or not enough independent or competent about Student's Theme, the Board will ask the Tutor to propose the name of an external *Reviewer*, who will be asked to give an evaluation of the submitted documents and take part of the public meeting with the Student. Nor the *Tutor* nor the *Supervisor* may be appointed as *Reviewer*.
The frequency of the meetings of the Students with the Board is twice a year, one about every six months. The first of these meetings every year has just an overview mission. The second every year have the formal role of assessment and admission of the Student to the next year. After this annual meeting, the Student will receive a motivated evaluation.
If the evaluation is positive (A/B/C/D), he will be admitted to the next year. Last year Students, also with positive final evaluation, if needed and suggested by his/her Tutor, may ask for a time extension up to a maximum of 12 months.
If the evaluation is negative, the Student will be qualified as a "Repeating candidate"(Er) or "not able to continue with the PhD (Ei)".

Milestone 1 – 6 months

The candidate presents the Academic Board the main research issues arising from his/her first overview of the State of the Art and Reference Bibliography for the Research Area/Topic under investigation.

Milestone 2 – 12 months (1st year annual exam)

Presentation of the research project (problems, final *State of the Art* and *Reference Bibliography*, first Thesis hypotheses, methodologies, expected outcomes), of the future work plan (foreign stay must be defined and proposed ASAP), of the main *Training Program* changes and of the first scientific products. A Supervisor may be identified and appointed to support the elaboration of the Student's research.

Milestone 3 – 18 months

Presentation of research progress, the main Training Program changes and scientific products. The PhD-Program Board review the feasibility, the originality and the scientific relevance of Student's Research, on the basis of the evaluation of the Tutor evaluation. Student's Supervisor is definitely appointed.

Milestone 4 – 24 months (2nd year annual exam)
First draft of the thesis work; research progress, main Training Program changes and scientific products. The Board examines and assesses the value and the originality of the research, on the basis of Tutor's and Supervisor's documented evaluation.

Milestone 5 – 30 months
Draft of the PhD thesis (with a complete list of contents), of the main Training Program changes and scientific products. The PhD-Program Board assesses the advancements, the feasibility and the valuing opportunities of the PhD thesis, on the basis of Tutor's and Supervisor's documented evaluation. The opportunity of a Reviewer is evaluated as proposal of the Tutor and the Supervisors.

Milestone 6 – 36 months (3rd year annual exam)
Presentation of the thesis in its final version (except amendments and reviews after this last meeting). The Academic Board decides on admission to the final exam.

6.5 The *PhD Thesis*

The main objective of a PhD Student is the development of an original research contribution. This contribution will be reported in the Student's PhD Thesis, to be written under the guidance of a *Supervisor*.
Student's *Supervisor* is a specialist in Student's *Research Topic* who will support the Student in setting-out and developing everyday research activities.
Supervisor's role may be assumed by the *Tutor*, who will anyway propose and oversee his/her name, or by another member of the PhD Program Board or by other experts from Politecnico di Milano as well as from any other Research Institution. One or more co-supervisors, if requested, may be appointed by PhD Program Board.

At the end of the third year, the Student's Thesis will be reviewed and evaluated in a public meeting, in order to admit him/her to the Final PhD-Exam. The Student will present his/her Tesis to the *PhD Program Board* and to the appointed external *Reviewer*(s).
Nor the *Tutor* nor the *Supervisor* may be appointed as *Reviewer*, who will be chosen among those specialists in Student's *Research Topic* that have not had any direct relation with the Student or his/her Tutor or Supervisors. The Reviewers will evaluate the contribution to the State of the Art given by the Student's PhD Thesis, in the chosen *Research Field*.
Subsequently, the final PhD-Exam will be organized for the attainment of the title, in which the research work carried out and the thesis will be evaluated by an examination Committee composed by three members, of which at least two external evaluation members.

7. Laboratories, PhD Secretary Services

7.1 Experimental facilities

The ABC-PhD Program has the experimental support of all the laboratories of Politecnico di Milano. The involvement of these Laboratories will be planned in the Training Program and organized following the Training Program needs.

The Department, in particular, may offer experimental facilities – directly managed or participated – with the following objectives:

- for testing ***entire structures*** under static/dynamic/fatigue loads (steel and concrete structures);
- for the investigation of ***advanced cement-based composites***;
- for the mechanical testing and technical approval of ***textiles***.
- for the investigation of ***soil-structure interaction***;
- for the investigation of ***fire and blast interaction***;
- for the assessment of ***local climate***, weather and weathering conditions;
- for testing the ***durability*** of building components;
- for the assessment of ***radiative properties*** of building surfaces and components;
- for the ***survey and the diagnosis*** of existing building performances and degradation conditions;
- for the evaluation of ***acoustic climate, conditions and performances*** of the built environment and building comoponents;
- for testing ***solar components*** (thermal and photovoltaic).

7.2 Computational resources

For high performance computing applications, students may rely on CILEA (Consorzio Interuniversitario Lombardo per l'Elaborazione Automatica, www.cilea.it, owner of supercomputers among the 500 most powerful in the world); CILEA offers simple and complex services, up to the most complete assistance in the development of new simulations and applications, with its state-of-the-art computing platforms.

7.3 PhD Secretariat

In this Office Candidates and Students will receive information about deadlines to be respected, Courses, Training Programs etc. Foreign students are also supported for the specific services they offered such as Italian courses, housing, residence permits. The Office provides information about the possibility of joining a double PhD courses in agreement with foreign Universities. Contact: Arch. Cristina Marchegiani: dottorato.abc@polimi.it, Phone number. +39.02.2399 2614; site: http://www.ABC.polimi.it/

8. Internationalisation and other activities

A long period of study and research activities carried on in other laboratories and with other research groups, in particular abroad, is strongly recommended. Long sojourns are possible up to 18 months.
In these cases, scholarships are increased by 50%. The sojourns require a formal approval by the Board of Professors. Additional funds, for long travel/stays abroad, may be available from various PhD funding.
Politecnico di Milano proposes also the opportunity of joint PhD Degrees or Double PhD Programs with foreign universities. Further information is available on the PhD School Website and on the ABC Website.

9. Reference Committee

The ABC-PhD Board appoints the members of a Reference Committee is supported by a *Reference Committee*, consisting of distinguished representatives from industrial, social and economic bodies, for a better

understanding of the specific research societal needs and the prospective request of researchers in industry and other public or private organisations, at a national and international level. The Reference Committee supports the Board also to assure (and improve) the quality of the Program and to propose and sponsor new initiatives related to the ABC-PhD Programs.
Every year, the ABC-PhD Program Board defines – or confirms – the number of the Reference Committee and appoints its members.

***Table A**: Multidisciplinar ABC-PhD Courses*

SSD	Title	CFU	Proposer
ICAR12 + others	Technological innovation for architecture – First Part: theories, methodologies and tools	5	A. Campioli
ICAR12 + others	Technological innovation for architecture – Second Part: case studies	5	A. Campioli
ICAR12 SECSP06	Il progetto e la gestione del patrimonio culturale per lo sviluppo socio-economico	5	D. Fanzini A. Tartaglia G. Casoni
ICAR19 ICAR06	Analisi, rappresentazione e conservazione dei beni culturali	5	S.Della Torre V.Pracchi, R.Brumana
ICAR19 ICAR10	Planned Conservation of Cultural Heritage	5	S. Della Torre, A. Ronchi
ICAR10 INGIND13 INGIND11	Building-Boundary Layer Interaction: Radiative and Convective Phenomena and Building Envelope Design	5	T.Poli A.Zasso E. De Angelis
ICAR10 INGIND13 ICAR08/09	Building-Boundary Layer Interaction: Wind Engineering for Building Envelope Design	5	E. De Angelis A.Zasso M.Pisani
ICAR10 ICAR09 ICAR11 ICAR12 ICAR14	Retrofit and Transformation of the Built Environment Part I Introductory lessons + Part II Workshop	5+5	G.Masera
ICAR11 ICAR10 ICAR12	La ricerca per l'innovazione dei processi nel settore delle costruzioni	5	B.Daniotti

***Table B**: Other ABC-PhD Courses.*

SSD	Title	CFU	Proposer
INGIND11	Energy Efficiency in Building Design, Urban and Regional Planning	5	G. Dall'O
ICAR12	Sheltering for emergency	5	A. Zanelli
ICAR 12	Technological culture of design	5	F. Schiaffonati M. Gambaro E. Faroldi
ICAR 12 MED 42	Environmental and landscape design: methods and tools for heritage enhancement	5	E. Mussinelli R. Bolici S. Capolongo
ICAR08 ICAR09	Solid mechanics for discrete modelling of structures – First part	5	L. Biolzi
ICAR08 ICAR09	Solid mechanics for discrete modelling of structures – Second part	5	S. Casolo
ICAR08 ICAR09	Structural Dynamics for condition assessment and seismic monitoring	5	C. Gentile
ICAR08 ICAR09	Seismic vulnerability of buildings and risk mitigation	5	M.A. Parisi
ICAR12	I processi gestionali innovativi nel settore delle costruzioni/immobiliare	5	O.Tronconi

***Table C:** COURSES* offered by *PhD School* (see the PhD School site for a complete list: at least 5 ECTS among PhD School courses are mandatory) and by other PhD Courses *of Politecnico di Milano*.

SSD	Title	ECTS	Proposer
ICAR08	Mechanics of Heterogeneous Media	5	V. Carvelli
SECSP06	Economic Assessment of Urban Transformations and Policies	5	R.Capello
ICAR05	Planning Mobility and Accessibility in Emergency Situations	5	L.Mussone
ICAR12	Design, Technologies and Innovation in Cultural Heritage Enhancement	5	E. Mussinelli
ICAR09	Non linear behaviour of concrete structures and their design principles	5	M.Pisani – SSGE PhD Program