# PhD Course in
# Space Sciences, Technologies and Measurements

# Corso di Dottorato in
# "Scienze Tecnologie e Misure Spaziali (STMS)"

## University of Padua - Italy

http://cisas.unipd.it/dottorato/corso-di-dottorato

## PhD Course Specifications and Program for the 31th cycle
## (updated on 2 October 2015)

## Foreword

This Document describes the STMS PhD Course composition, activities, structure and resources foreseen for the 31th cycle starting on October 2015.

This Document is yearly updated by the PhD Course Board. It serves as a guide to facilitate professors and doctoral students during the PhD period. Its content is meant to be applied without rigidity, with the only requirement to fully satisfy the main goals of the PhD Course, namely to provide excellence in education and formation. Variations to what here written are possible under acceptance of the PhD Course Board, always staying within the limitations foreseen by the Academy and PhD Course Rules.

Doctoral students follow the indications given in the Document corresponding to the year of enrollment, unless differently stated by the STMS PhD Course Board.

# Contents

# 1 STMS PhD Course Rationale

The main purpose of the Space Sciences, Technologies and Measurements (STMS) PhD Course (hereafter, the Course) is the formation of Research Doctors able to realize research in disciplines connected with Sciences, Technologies and Measurements for Space with a broad vision of the respective problematic. Doctoral students usually operate within defined programs and experiments of interest for the Course Curriculum research subjects, acquiring wide and interdisciplinary knowledge, learning methodologies and techniques.
The educational process shall enable students to acquire skills and credits toward a University career, and/or a position in other Research Institutes, or Industries. It should also stimulate the potential capabilities of the doctoral student to induce a fall-out of his/her knowledge in the territory, to stimulate the growth of high tech spin-offs, to improve local industry's ability to compete in the wider national and international scenario. A corollary of the above approach is the formation of Research Doctors capable to raise to leadership levels in scientific and/or industrial programs.

The STMS PhD Course derives from merging two previous PhD Courses, *Space Sciences and Technologies*, and *Mechanical Measurements for Engineering*, that has enlarged the capability of the Course to satisfy its ambitious vision.

The usefulness of mechanical measurements in space sciences and technologies stems from the following considerations:
- every space mission is based on the realization of a number of physical models on which campaigns of measurements aimed to verification and qualification of the unit are performed
- the interpretation of results and their applicability to the flight model is deeply tied to mechanical measurements
- methodologies for instrument design and test require measurements of testing facilities and instrumentation, plus calibration of devices, avionics and instrumentation itself
- robotics for orbital servicing and planetary exploration requires the measurement of various environmental quantities, trajectory planning and process control

Concerning the utility of space sciences and technologies in the field of mechanical measurements, it is evident that a space mission always gives the opportunity to test new and innovative methodologies of measuring in harsh environments. Such methodologies actually can be used in applications other than space, for instance:
- vision system for measuring and control
- innovative application of laser vibrometry
- no-contact deformation measurement
- measuring techniques for diagnostics and quality control
- no contact torque measuring techniques on engines and operative machines
- measuring techniques of contact pressure distribution
- opto-mechanical sensors for measuring mechanical quantities in medicine
- innovative measuring techniques for diagnostics in rotating shaft and metal tube
- Clinical diagnostics

# 2 Involved institutions

The reference University Institution for the STMS PhD Course is the Center of Studies and Activities for Space (in Italian "Centro di Ateneo di Studi e Attività Spaziali", hereafter CISAS) "Giuseppe Colombo", for administration.

The Departments involved in the STMS PhD Course are:

*University of Padova:*
Civil and Environmental Engineering, Geosciences, Industrial Engineering, Information Engineering, Physics and Astronomy, Mathematics

*from other Italian Universities:*
Design and Planning in Complex Environments (IUAV, Venice), Industrial Engineering (University of Perugia), Mechanical and Industrial Engineering (University of Brescia), Mechanics (Polytechnics of Milan)

For any information relative to the STMS PhD Course, the reference person are Prof. Giampiero Naletto (Coordinator, naletto@dei.unipd.it), Prof. Daniele Pavarin (Deputy Coordinator, daniele.pavarin@unipd.it) Dr.ssa Federica Sannito (PhD Secretary, federica.sannito@unipd.it), and Marika Zago (Administration Secretary, marika.zago@unipd.it).

Course address:
Corso di Dottorato in "Scienze Tecnologie e Misure Spaziali (STMS)"
c/o Centro di Ateneo di Studi e Attività Spaziali "Giuseppe Colombo"
Via Venezia 15
I-35131 Padova - Italy

## 2.1 International Agreements

The STMS PhD Course has a convention with the "Astrophysique et Techniques Spatiales" PhD School of the Université Denis Diderot (Paris-7) for the joint release of the PhD title.
Since 2006 a Protocol of agreement is active with the Ecoles Doctorales de l'Ile-de-France for a joint title in "co-tutelle".
Since December 2010 the STMS PhD Course is included in the international network IDPASC (International Doctorate Network in Particle Physics, Astrophysics and Cosmology, http://www.idpasc.lip.pt/).

# 3 Academic Disciplines and Scientific Areas

The academic disciplines relevant for the STMS PhD Course are (University Ministry codes):

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|---|---|
| FIS/01: | Experimental Physics |
| FIS/05: | Astronomy and Astrophysics |
| GEO/10: | Geophysics of the Solid Earth |
| ING-IND/04: | Aerospace Constructions and Structures |
| ING-IND/05: | Aerospace Plants and Systems |
| ING-IND/06: | Fluid dynamics |
| ING-IND/07: | Aerospace Propulsion |
| ING-IND/11: | Environmental Technical Physics |
| ING-IND/12: | Mechanical and Thermal Measurements |
| ING-IND/32: | Converters , Machines and Electrical Switches |
| ING-IND/34: | Industrial Bioengineering |
| MAT/07: | Mathematical Physics |

The main scientific area relevant for the STMS PhD Course is (University codes):

| | |
|---|---|
| 10: | Industrial Engineering |

Other scientific areas of interest for the Course are:

| | |
|---|---|
| 1: | Mathematical Sciences |
| 2: | Physical Sciences |
| 5: | Earth Sciences |
| 11: | Information Technologies |
| 17: | Psychological Sciences |

# 4 Curricula and Fields of Expertise

In order to provide not only a broad, interdisciplinary vision, but also a specific competence in particular fields, two Curricula have been instituted in the STMS Course:

- Mechanical Measurements for Engineering and Space (in Italian, Misure Meccaniche per l'Ingegneria e lo Spazio, MMIS)
- Sciences and Technologies for Aeronautics and Satellite Applications (in Italian, Scienze e Tecnologie per Applicazioni Satellitari e Aeronautiche, STASA)

## 4.1 Fields of Expertise of the MMIS Curriculum

- Analysis and definition of measuring methodologies and data processing
- Definition of methods to evaluate the uncertainty
- Design and setup for laboratory experiments simulating harsh environmental conditions
- Design and set up of measuring and testing devices for opto-mechanical and ultrasonic instrumentations
- Functional analysis of instrumentation and representation through general theory
- Industrial installation and equipment testing with the design of optimal measuring system
- Innovative procedures for measuring by means of non-conventional methods
- Measurements of time variable phenomena with on-line data processing and industrial process monitoring
- Measuring techniques in clinical diagnostics
- Methods to validate interpretative models in industrial and clinical diagnostics
- Mechanical system testing; development, acceptance and qualification tests

## 4.2 Fields of Expertise of the STASA Curriculum

- Advanced Robotics; Mechanisms and Tethers in Space
- Design, verification and test of laboratory simulation in harsh environment
- Dynamics of Space Flights and Attitude Control
- Interaction between Spacecraft and Space Environment
- Mission analysis for Universe and Earth Observations
- Observations and Exploration of Solar System and Universe
- Observation of Earth from Space
- Optics and Scientific Instruments for Space
- Photon Detectors from soft-X rays to near infrared
- Physics of Planets, Moons, Comets, Asteroids
- Space Navigation
- System Engineering and Mission Analysis
- Structural and thermal analysis of Space Systems

# 5 STMS PhD Course Governing Bodies

According to Art. 9 of the University Regulations for PhD Courses (in Italian, Regolamento di Ateneo), the following Course governing bodies have been instituted:

a) the Course Coordinator
b) the PhD Course Board ("Collegio docenti")

Their composition and capacities are specified by the University Regulations document (Art. 10, 11, 12, 13 and 14), and by the specific Course's Regulations (in Italian, Regolamento dei Corsi di Dottorato).

The present composition of the governing bodies is the following:

*Coordinator*: Prof. Giampiero Naletto
*Deputy Coordinator*: Prof. Daniele Pavarin

*PhD Course Board*:

| First name, Last name, Institution, e-mail | Title | SSD |
|---|---|---|
| Cesare Barbieri cesare.barbieri@unipd.it<br>University of Padova, Dip. Fisica e Astronomia | Expert | (FIS/05) |
| Dario Bisello dario.bisello@pd.infn.it<br>University of Padova, Dip. Fisica e Astronomia | Professor | FIS/01 |
| Pierfrancesco Brunello pierfrancesco.brunello@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Professor | ING-IND/10 |
| Giuseppe Buja giuseppe.buja@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Professor | ING-IND/32 |
| Alessandro Caporali alessandro.caporali@unipd.it<br>University of Padova, Dip. Geoscienze | Professor | GEO/10 |
| Stefano Casotto stefano.casotto@unipd.it<br>University of Padova, Dip. Fisica e Astronomia | Researcher | FIS/05 |
| Riccardo Claudi riccardo.claudi@oapd.inaf.it<br>Padova, INAF OAPD | Researcher | (FIS/05) |
| Gabriele Cremonese gabriele.cremonese@oapd.inaf.it<br>Padova, INAF OAPD | Researcher | (FIS/05) |
| Vania Da Deppo dadeppo@dei.unipd.it<br>Padova CNR-IFN | Researcher | (FIS/01) |
| Stefano Debei stefano.debei@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Professor | ING-IND/12 |
| Giordano Franceschini franceschinigiordano@gmail.com<br>University of Perugia, Dip. Ingegneria Industriale | Professor | ING-IND/34 |
| Alessandro Francesconi alessandro.francesconi@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Professor | ING-IND/05 |
| Ugo Galvanetto galva@dic.unipd.it<br>University of Padova, Dip. Civile, Edile e Ambientale | Professor | ING-IND/04 |
| Massimiliano Guzzo guzzo@math.unipd.it<br>University of Padova, Dip. Matematica | Professor | MAT/07 |
| Matteo Lancini matteo.lancini@unibs.it<br>University of Brescia, Dip. Ingegneria Meccanica e Industriale | Researcher | ING-IND/12 |
| Enrico Lorenzini enrico.lorenzini@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Professor | ING-IND/12 |

| | | |
|---|---|---|
| Manente Marco marco.manente@unipd.it<br>University Spin-off | Expert | ING-IND/07 |
| Francesco Marzari francesco.marzari@unipd.it<br>University of Padova, Dip. Fisica e Astronomia | Researcher | FIS/05 |
| Giovanni Moschioni giovanni.moschioni@mecc.polimi.it<br>Milan Politechnics, Dip. Meccanica | Professor | ING-IND/12 |
| Giampiero Naletto giampiero.naletto@unipd.it<br>University of Padova, Dip. Ingegneria dell'Informazione | Professor | FIS/01 |
| Daniele Pavarin daniele.pavarin@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Researcher | ING-IND/07 |
| Maria-Guglielmina Pelizzo pelizzo@dei.unipd.it<br>Padova, CNR-IFN | Researcher | (FIS/01) |
| Francesco Picano francesco.picano@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Professor | ING-IND/06 |
| Fabio Peron fperon@iuav.it<br>IUAV Venezia, Progettazione e pianificazione in ambienti complessi | Professor | ING-IND/11 |
| Marco Pertile marco.pertile@unipd.it<br>University of Padova, CISAS | Expert | ING-IND/12 |
| Gianluca Rossi gianluca@unipg.it<br>University of Perugia, Dip. Ingegneria Industriale | Professor | ING-IND/12 |
| Mirco Zaccariotto mirco.zaccariotto@unipd.it<br>University of Padova, Dip. Ingegneria Industriale | Researcher | ING-IND/04 |
| Paola Zuppella zuppella@dei.unipd.it<br>Padova CNR-IFN | Researcher | (FIS/01) |

In addition, there are also annually elected PhD student representatives. The number of doctoral student representatives is given by excess rounding the 15% of the total number of the Board components. Their participation is limited (by the Rules) to questions related to didactical and organization aspects.

# 6 Training Project

The standard duration of the PhD activity is three years. The PhD title is obtained having overall acquired 180 ECTS (European Credit Transfer and Accumulation System[1]) credits, and having conducted research activities with original contributions. In this document we adopt the equivalence of the Ministry of Education for International Doctorate which foresees 1 ECTS credit = 25 working hours (it is usually considered that there are 1,500 working hours in a year).
It is also assumed, in order to quantify the commitment to training the student, the equivalence between the ECTS credit and the university credit (CFU).
These credits are allocated according to the following scheme:
• 30 ECTS credits in three years for *education*: this includes lectures, modules, and seminars, plus hours of study, participation to schools, courses and conferences, and generally all the activities foreseen in Art. 19 of the University Rule document
• 150 ECTS credits for *research*, culminating in the PhD thesis.

## 6.1 Education

Training formation is divided into educational activities aiming to provide a common background to all PhD students (interdisciplinary modules) and in educational activities more specifically dedicated to each Curriculum.

### 6.1.1 Interdisciplinary education

In the following there is the description of the foreseen interdisciplinary education activities, common to both STASA and MMIS Curricula, as well the relative exam procedures.

#### *6.1.1.1 Interdisciplinary modules*

The Course is characterized by specific scientific topics, which are at the basis of the interdisciplinary education. To provide an adequate background on these topics to all PhD students, the Course activates every year 20-hour interdisciplinary modules as listed below; each module is associated to a specific academic discipline (FIS/01, FIS/05, ING-IND/04, ING-IND/05, ING-IND/07, ING-IND/12).

- Aerospace propulsion (Prof. D. Pavarin / Prof. M. Manente) (ING-IND/07)
- Exploring the solar system and its environment (Prof. Cremonese / Prof. Marzari) (FIS/05)
- Fundamentals of measurements and PC-based applications (Prof. Debei / Prof. Lancini) (ING-IND/12)
- Mechanical and thermal properties of material for aerospace constructions (Prof. Galvanetto / Prof. Zaccariotto) (ING-IND/04)
- Space optics and detectors (Prof. Naletto / Prof.ssa Pelizzo) (FIS/01)
- Spacecraft Dynamics and Control (Prof. Francesconi / Prof. Lorenzini) (ING-IND/05)

The module syllabi are given in Appendix 8.1.

Students have to reach a “complete” interdisciplinary formation. This is done by providing evidence of having obtained ECTS credits in all the academic disciplines specified above. This can be done either attending and passing the exams of these interdisciplinary modules, or passing analogous exams of university courses. It is assumed that students may have already passed university exams on some of these topics during their pre-doctoral formation: in this case, they have not to attend the corresponding PhD interdisciplinary modules (i.e. these exams will be granted for the completion of the interdisciplinary formation, even if no credit can be claimed for them). In the case of students which do not have any pre-

[1] ECTS is based on the convention that 60 credits measure the workload of a full-time student during one academic year. The workload of a full-time study program in Europe amounts in most cases to 36/40 weeks per year and in those cases one credit stands for workload variation from 24 to 28 hours a week. The workload refers to the time in which it is believed that an average student can achieve the required learning outcomes.

doctoral formation on these disciplines, exception to this rule can be considered by the Course Coordinator on the basis of the provided formation plan and of the foreseen research project.
For every hour of lecture, 4 hours of study are assumed, so each 20-hour passed module is equivalent to (20+4*20) / 25 = 4 ECTS credits. Lectures are usually held at CISAS during the university "semesters", which correspond to Oct-Jan and Mar-Jun periods. The calendar of the modules is usually provided a couple of months after the official beginning of the PhD cycle. Attending a module without doing the exam allows the acquisition of a number of credits corresponding to the hours of frequency only and not of study (20 hours: 20/25 = 0.8 ECTS credits). Students must indicate in their personal training plan (see section 6.1.3) which modules they intend to attend, and on which they intend to make the exams.
In addition to these modules, there is another 10-hours interdisciplinary module mandatory for *all students*:

- Preparing a Scientific Paper / Research Project Proposal (Prof. G. Naletto)

The exam to this module is also mandatory, providing the acquisition of 2 ECTS credits.

Lectures on the same/similar subjects can also be attended in other universities, with permission of the Course Coordinator. In special cases (for example in case of a prolonged stay abroad), a doctoral student may be exempted from attendance at lectures, or at some of them; however, the student has anyway to pass the relative exams. Attendance at any course/module which is not activated by the Course, as well passing the related exam, must be properly documented by the course/module lecturer: the lecturer has to fill in the "Passed exam" form in Appendix 8.2 (the filled form must be given by the student to the Course Secretary).

In addition to the modules listed above, students are suggested to attend at seminars on topics of interest for the Course. Attendance at these seminars will be accounted in the calculation of ECTS credits (1 hour seminar equal to 1/25 ECTS credit). To validate these credits, either the lecturer or the Course Coordinator has to sign the student record book (if available).

The number of ECTS credits usually achieved as a minimum with mandatory interdisciplinary modules is 2×4+2*0.8+2 = 11.6, to which credits achieved with other interdisciplinary activities have to be added.

#### *6.1.1.2 Interdisciplinary module exams*

The course lecturer informs the student on the way in which the exam will be done (it is suggested to have the exam as an oral or written test). The exam of each module has to be done within one month after the end of the module; a two-month time is allowed for making the exam when two or more modules which concluded within 30 days have been attended.
The exam on "Preparing a research proposal" module may consist in the actual preparation of an application for funding, for example along the lines of University Calls for Young Researchers, or of ESA Calls for the Rexus/Bexus Programs, or also more challenging calls. This exam can also be done in group, involving more doctoral students on the same proposal: in this case, each student has to highlight his/her contribution to the proposal. It can also be considered the possibility of an effective application of the proposal to a call for funding, in which case, the submission of the proposal must be previously agreed with the student supervisor.
One of the interdisciplinary module exams, chosen by the student, and finalized to assess the teaching skills of the doctoral student, has to be held in the form of an academic lecture of about 30 minutes. The lecture has to be structured to be addressed to a potential audience of students. The lecture has to be described in an analytical and sequential way, properly detailing several aspects to improve the understanding of the subject, or of any complex logical steps. This exam has to be done by each doctoral student as it is mandatory to be admitted to the final exam. If both PhD student and professor agree, there is the possibility to have this exam as a real lecture, actually teaching to the first year PhD student during one of the foreseen modules, under the supervision of the Professor.

After the exams, an evaluation of the student performance is provided: the possible scores are A (excellent), B (good), C (sufficient) , D (not sufficient) and in between. In the latter case, the test has to be repeated.
Each positively passed exam must be validated by the professor responsible of the module, filling in the "Passed exam" form (see Appendix 8.2); the filled form must be delivered by the student to the Course Secretary.
All the exams on the interdisciplinary modules must be completed within the second year of PhD (with the exception of that for the 10-hour mandatory module that can be done also during the third year): this is a necessary condition to be admitted to the third year. Derogations may be granted by the Course Board in special cases such as prolonged staying abroad.

#### *6.1.1.3 Other interdisciplinary activities*

Doctoral students may participate, after having informed the Course Board, to the ESA Rexus/Bexus Programs, as this activity is extremely educational. In this case, the doctoral students acquire 6 ECTS credits, which can be used as an alternative or complement to other interdisciplinary activity.
The participation to the National School on "Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics", which is held every two years at the National Laboratories of Legnaro (http://sirad.pd.infn.it/scuola_legnaro) is automatically recognized as interdisciplinary training activity; it is strongly suggested to attend this School. Doctoral students following this National School acquire ECTS credits as indicated in section 6.1.2.4.
The STEPS (Seminars Towards Enterprise for Ph.D Students) course activated by the University of Padova in collaboration with Camera di Commercio I.A.A. of Padova, Gruppo Giovani Imprenditori di Confindustria Padova and Fòrema Scarl is one of the University interdisciplinary courses dedicated to doctoral students. The frequency to this course is useful in terms of credits to be considered in the student credit account.
Doctoral students, if willing, can attend the English Language courses activated by the University Language Centre (http://cla.unipd.it/attivita/corsi-a-pagamento/inglese-diy/), since it is considered fundamental for a student of this Course an excellent knowledge the English language.
Foreign students can attend the "Italian for foreigners" courses activated by the University Language Centre (http://cla.unipd.it/attivita/italiano-l2/dottorandi/). This course, however, is not considered valid for credit acquisition.

The following events, to which the students are always expected to attend, are considered part of the interdisciplinary education. For any participation/presentation, students will obtain credits as indicated:

- Presentations done by the first year doctoral students admitted to the Course of their proposed three-year PhD research program (1/6 ECTS credit for attendance; 1/3 ECTS credit for presentation)
- Presentations done by the doctoral students of the activities done during the year (for first and second year students), or of the activities of the three years (for third year students) (0.5 ECTS credits for each event)

Presentations for admission to the third year and to the final exam (or extension request) must be made in English.

It is required to have obtained a minimum of 10 ECTS credits through interdisciplinary activities for being admitted to the final exam.

### 6.1.2 Curriculum oriented educational activities

In the following there is the description of the foreseen curriculum oriented education activities, as well the relative exam procedures.

#### *6.1.2.1 Curriculum oriented seminars*

Each year, the Course organizes a series of 2-hour curriculum oriented seminars held by professors of the Course. The speakers will provide the most updated information about some of their research activities, or

about a specific topic of potential interest for the PhD Course. Also speakers external to the Course can be invited.
These seminars should have the spirit of an exchange of ideas between the speaker and the audience, a sort of open discussion on the described arguments. On this respect, following the conclusion of the seminar, the doctoral students will prepare a short "summary" (either in the form of a written report, or as a short presentation) where they provide some comments on the discussed topics, needs of clarification, and proposals of in-deep discussion of some specific points. Within two weeks after the seminar, the speaker and the students meet again to discuss all together the points provided in the summaries. At the end of this second meeting, the students will acquire the credits relative to the seminar.
The calendar of the seminars is provided each year a few months after the official beginning of the PhD cycle. For every hour of these seminars 4 hours of study are assumed, so passing the exam of each curriculum oriented seminar is equivalent to (2+4*2) / 25 = 0.4 ECTS credits. Doctoral students are invited to attend as much curriculum oriented seminars as possible, and to make the relative exams (i.e. participating to the final discussions). It is mandatory to acquire at least 6 credits ECTS (15 seminars) by means of the curriculum oriented seminars during the three year Course; exceptions are possible in case of long periods spent abroad.

#### *6.1.2.2 University courses*

For his/her specific training, a doctoral student can also choose other University/PhD courses and/or modules relative to the chosen Curriculum. These courses must be approved by the Course Coordinator.
The following undergraduate courses, if chosen by a doctoral student of MMIS Curriculum, do not require formal approval:

- Instrumentation and transducers for mechanical measurements (Prof. S. Debei)
- Astrodynamics (Prof. E. Lorenzini)
- Aerospace instrumentation (Prof. E. Lorenzini)

The following undergraduate courses, if chosen by a doctoral student of STASA Curriculum, do not require formal approval:

- Elements of astronomy and astrophysics (Prof. C. Barbieri)
- Industrial applications of ionizing radiation sources (Prof. A. Candelori)
- Theory of orbits (Prof. S. Casotto)
- Comets and small bodies (Prof. M. Lazzarin)
- Space Optics Instrumentation (Prof. G. Naletto)

For University courses the correspondence between CFU and ECTS credits is assumed.

#### *6.1.2.3 Curriculum oriented course exams*

The positively passed exam will be validated by the professor responsible of the course, which will fill in the "Passed exam" form (see Appendix 8.2). The form must be delivered to the Course Secretary by the student who has passed the exam.

If a doctoral student attends a university course/module, it is assumed that the student also carries out the relative course exam; in this case, after successfully passing the exam, the course is assigned a number of ECTS credits equivalent to the course CFU's. The exam must be certified by the lecturer of the course filling in the "Passed exam" form (Appendix 8.2). The completed form must be delivered by the student to the Course Secretary.

Some doctoral students have, as their main research task, the extensive development of codes/software packages for a potential distribution to other users, or the integration of routines/software libraries in

already existing professional software. In these cases, the students have to comply with the standards commonly used for software development, and for this purpose appropriate documentation can be made available. These doctoral students will have to demonstrate the understanding of these standards and their application in the developed software codes. This can be done by means of a “software review”, which is an optional exam where these students must properly describe the structure of the piece of software made. The software review (supervised by Prof. Casotto) is dedicated to the students of the third year; this exam involves the acquisition of 2 ECTS credits.

#### *6.1.2.4 Other Curriculum oriented educational activities*

Doctoral students can dedicate every year some time on tutoring or on educational support (in Italian, “didattica integrativa") activities (NB: the latter is limited to maximum 40 hours/year; after the third year, in case of an extension period, there is no longer the 40 hour/year limitation). These activities must be approved by Course Board, following the directions of the Academic Bodies. In Appendix 8.3 there is a template for the request to the Board. Credits related to teaching support are considered within the Curriculum dedicated educational activities, taking one hour lecture equal to 2/25 ECTS credits, up to a maximum of 4 ECTS credits/year.
Also participating in Schools, Courses and Conferences is considered as Curriculum dedicated formation activity: in this case, one hour of participation is assumed equivalent to 1/25 ECTS credit. Through this activity, each student can achieve up to 2 ECTS credits per year; the allocation of these ECTS credits is subject to the submission to the Course Coordinator and to the Course Secretary of proper documentation of participation in the School or Conferences. It is assumed the participation to a School/Congress/Conference at least once in three years.

It is required to have obtained a minimum of 10 ECTS credits through curriculum oriented educational activities for being admitted to the final exam.

### 6.1.3 Personal training plan

During the presentation of the proposed research program (October first year), first year doctoral students must provide a “personal training plan” with the indication of which modules activated by the Course they wish to follow. They must also include any other educational activity they plan to do, with an indication about the type of activity, the period in which this activity will be carried out and how many ECTS credits could be acquired. The template for the personal training plan can be found in Appendix 8.4.
At the end of the attendance of modules/courses of the first year (usually on June), first year doctoral students must update their personal training plan.
The personal training plan should then be updated twice a year (end of February and end of August), with the indication of the progress in achievement of ECTS credits in educational activities.
The training plan may be amended, upon approval of the Course Coordinator, until the end of the second year. Any changes to the training plan as foreseen by the Course have to be described in the personal training plan, and must be approved by the Course Coordinator.

The recommended distribution of credits achieved for the various educational activities is 50%, 40%, 10% ECTS credits in the first, second and third year respectively. However, the following minimum number of credits have to be obtained: at least 9 and at least 21 ECTS credits must be achieved at the end of August of first and second year, respectively. A smaller number may lead to the not-admission to the following year. Six months before the conclusion of the third year, all the foreseen ECTS credits for educational activities/training must have been obtained; exceptions are granted only in cases of prolonged suspension justified by the Course, or extended staying abroad.

## 6.2 Research

Research is the primary instrument of the doctoral training project, to which the student devotes more than 80% of the total workload in the three years of the Course. The research product should be innovative

and classified in at least one of the following categories: new tools/equipment, new know-how, new processes, new methods, publications, spin-off. In carrying out his/her research, under the tutoring of a supervisor (and, in the case, by a co-supervisor) assigned by the PhD Course Board, the doctoral student shall contribute original contents.
Doctoral students are strongly encouraged to spend some time in foreign research institutions, where studying in deep the undergoing research activity. To this end the University has a specific allocated budget to increase the basic PhD grant for periods abroad longer than 20 days. Periods longer than six months (even not consecutive) have to be approved by the PhD Course Board. The template for the request to the Board can be found in Appendix 8.5. An invitation (letter or e-mail) by the hosting institution should preferably be attached to the request.

## 6.3 PhD Thesis

The research realized by the doctoral student is documented by the doctoral thesis. The thesis must describe in an analytical way the research activity, highlighting the original contributions given by the doctoral student.
The supervisor verifies that the thesis is conformal to the foreseen activity program.

### 6.3.1 Thesis title and research objectives

The research subject of the doctoral thesis is identified since first year, giving it a title and defining its objectives and the international context. Under motivated circumstances, the proposed research may be changed during the first year, even substantially: this has to be agreed with the supervisor and must be approved by the Course Board. In the years following the first, the doctoral thesis can be adjusted with only minor changes, unless exceptional causes arise, and must be approved by the Course Board. The final title of the thesis must be determined at the end of the second year; later changes to the title must be approved by the Curriculum Board.

### 6.3.2 Foreign language thesis

The thesis can be written in Italian, in English or other foreign language agreed with the PhD Course Board. Since the topics covered in this Doctoral Course are often devoted to international scientific research that uses almost exclusively the English language, it is strongly suggested to write the thesis in English.
Please note that, as required by University regulations, to write the thesis in a foreign (not Italian) language it is in any case necessary to ask the permission of the PhD Course Board: this request must be made at the end of the first year of the PhD, when presenting the documentation for admission to the second year.
The thesis, regardless of the language in which it is written, must however contain a section summarizing the work done both in Italian and in English (or in another foreign language indicated by the PhD Course Board).

### 6.3.3 Summary of the doctoral student work

In order to facilitate the evaluation of the thesis by the members of the Final Exam Board, the doctoral student must include in the introductory part of the thesis a less than 3 pages summary also in bullet form indicating what are the actual contributions made by the student in the totality of the described work. This has to be done with references to the relevant sections, highlighting the original/innovative contributions.

### 6.3.4 Thesis development

The development of the doctoral thesis must start from the first year of PhD, on the basis of the program of the expected research activities.
For admission to the second year, the doctoral student must submit to the PhD Course Board:
- a complete index (content) of the thesis.

For admission to the third year, the student must submit to the PhD Course Board:

- a script of the thesis: the latter consists of a structured index, corresponding to the state of the work and to the prediction of future activities, and, for each section of the index, either a preliminary description of what the student will write in, or a draft of the final document.

For the admission to the final exam, the student must submit to the PhD Course Board:

- a draft of the thesis: this corresponds to about 50% of the final report, and must include both the summary in the foreseen second language and the summary of the doctoral student work.

In all cases, the supervisor checks that the work adheres to the foreseen program of activities of the student, and ensures that the quality and quantity of the text are appropriate for the current state of research.

### 6.3.5 Doctor Europaeus

Students who spent at least three months in a European Union country to work on their PhD research activity, may require the obtain the "mention" of Doctor Europaeus.
To achieve this:

- The thesis must be evaluated by at least two professors from two universities in two countries of the European Union other than the one in which the thesis will be discussed and that are not part of the Final Exam Board; their evaluations have to be forwarded to the members of Final Exam Board together with the PhD thesis;
- At least one member of the Final Exam Board must belong to an EU country other than that in which the thesis is discussed;
- Part of the discussion must take place in one of the official languages of the EU other than the country in which the thesis is discussed.

It is important to note that the need for an external audit of the thesis prior to the delivery of the same to the relevant offices implies that the thesis must be substantially completed well in advance of the delivery deadline (typically at least one month before the official date of delivery).

### 6.3.6 Other suggestions for the thesis editing

In the dissertation should be highlighted, wherever applicable, the topics covered in the interdisciplinary and curriculum dedicated courses, highlighting the connections between what has been learnt in these courses and the possible applications to the thesis topics.
In case dedicated software has been developed, it is desirable to adhere to European standards for appropriate documentation and usability, as already mentioned.

Note that the writing of the thesis typically requires about 10% of the total commitment for research (i.e. more than 3 months): it is required that the doctoral student provides adequate time for its preparation.

In order to avoid large differences in the layout of the thesis, it is recommended to follow the following standards:
- Font: Times New Roman 11/12 pt (or similar)
- Line spacing: 1 – 1.2 lines
- Margins (A4): 2.5 cm top, 2 cm bottom, 2 cm external, 2/2.5 cm internal

Finally, for additional information, Art.s 30-32 of the University Rules on Doctoral Thesis are here reported (in Italian) at Appendix 8.5.

# 7 STMS PhD Course Management

## 7.1 Doctoral student activity program

The activities of each doctoral student are documented by the "Analytical report of the doctoral activities". This report, which includes the personal training plan, shall be submitted to the PhD Course Board: at first shortly after admission to the Course for the approval of the training plan and of the proposed research, and then at the end of the academic year for the admission to following years and to the final exam. The template of the analytical report is given in Appendix 8.7.
To be admitted to the second and the third year as well as to the final exam, the doctoral student must also describe the ECTS credits acquired in educational activities by updating the personal training plan (March and September) and the thesis status. In addition, among the criteria to be considered for admission to the next year, also the update by the student of the personal CINECA web site will be considered.
For the admission to the final exam of a doctoral student, the supervisor has to prepare an evaluation form to be approved by the PhD Course Board. It must be attached (unbound) to the copies of the thesis for both the University and the members of the Final Exam Committee. The evaluation form template can be found in Appendix 8.8.

### 7.1.1 Research program guidelines

For better planning of activities, and to form a necessary managerial mentality, it is suggested to adhere to the following planning for the thesis development.

- To formulate a research program indicating both the scientific and technical content, and the foreseen amount of commitment (in man-hours, assuming 1500 working hours per year) in the form of Work Breakdown Structure (WBS); the WBS has to be developed at least to the first level for first year doctoral students, and at least to second level for admission to the second year.
- To illustrate the temporal evolution of the program through a GANNT Bar Chart, in agreement with the WBS. In the first year, it is convenient to expand the chart to have visibility on a quarterly basis for the first year, and at least on a six month basis for the other two years. From the second year, all the chart has to be expanded with at least 3 months of temporal resolution.

In the following there is an example of a program that takes into account theses of 3750 hours in 3 years, divided into quarterly man-hours for each work package (WP) indicated at the first level, and expanded as applicable to the third level.

| Level | | | Activity description (WP title) | hours | I year | | | | II year | | | | III year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **0** | **0** | **First level activity 1** | **1060** | **150** | **250** | **250** | **250** | **160** | | | | | | | |
| | 1 | 0 | Second level activity 1 | 250 | 150 | 100 | | | | | | | | | | |
| | | 1 | Third level activity 1 | 100 | 50 | 50 | | | | | | | | | | |
| | | 2 | … | 150 | 100 | 50 | | | | | | | | | | |
| | 2 | 0 | Second level activity 2 | 550 | | 150 | 200 | 200 | | | | | | | | |
| | | 1 | Third level activity 1 | 150 | | 100 | 50 | | | | | | | | | |
| | | 2 | … | 100 | | 50 | 50 | | | | | | | | | |
| | | 3 | | 100 | | | 100 | | | | | | | | | |
| | | 4 | | 200 | | | | 200 | | | | | | | | |
| | 3 | 0 | | 260 | | | 50 | 50 | 160 | | | | | | | |
| | | 1 | | 100 | | | 50 | 50 | | | | | | | | |
| | | 2 | | 160 | | | | | 160 | | | | | | | |
| **2** | **0** | **0** | **First level activity 2** | **1070** | | | | **250** | **280** | **300** | **145** | **95** | | | | |
| | 1 | 0 | Second level activity 1 | 400 | | | | 190 | 140 | 70 | | | | | | |
| | 2 | 0 | Third level activity 2 | 670 | | | | 60 | 140 | 230 | 145 | 95 | | | | |
| | | 1 | … | 390 | | | | 60 | 140 | 130 | 45 | 15 | | | | |
| | | 2 | | 280 | | | | | | 100 | 100 | 80 | | | | |
| **3** | **0** | **0** | | **1070** | | | | | | | | **100** | **350** | **350** | **200** | **70** |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | | 600 | | | | | | | | 100 | 200 | 200 | 100 | |
| | 2 | 0 | | 470 | | | | | | | | | 150 | 150 | 100 | 70 |
| **4** | **0** | **0** | **Writing Thesis and reports** | **550** | | | | | **20** | **35** | **50** | **70** | **45** | **80** | **100** | **150** |

*Note: X00 is a level 1 WP, XY0 is level 2 WP, XYW is level 3 WP. Students beginning the first year should show an analysis at least to level 1; for admission to second year, an analysis to at least level 3 is requested. Note: it is convenient to not exceed with the first level WP (i.e., no more than 9).*

Then, for each Level 1 WPs, describe in not more than 3 lines their characteristic technical content, in order to justify the sublevels indicated in the WBS.

| WP | Technical Description |
|---|---|
| 100 | |
| 200 | |
| 300 | |

Finally provide the foreseen schedule of the activity, by means of a GANNT diagram.

| Level | | | Activity Description (WP title) and events | I year | | | | II year | | | | III year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Event | | | Presentation for approval of Research | ▼ | | | | | | | | | | | |
| 1 | 0 | 0 | | | | | | | | | | | | | |
| | 1 | 0 | | | | | | | | | | | | | |
| | | 1 | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | |
| | | 1 | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | |
| | | 4 | | | | | | | | | | | | | |
| | 3 | 0 | | | | | | | | | | | | | |
| | | 1 | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | |
| Event | | | Admission to II year | | | | ▼ | | | | | | | | |
| 2 | 0 | 0 | | | | | | | | | | | | | |
| | 1 | 0 | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | |
| | | 1 | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | |
| Event | | | Admission to III year | | | | | | | | ▼ | | | | |
| 3 | 0 | 0 | | | | | | | | | | | | | |
| | 1 | 0 | | | | | | | | | | | | | |
| | 2 | 0 | | | | | | | | | | | | | |
| Event | | | Admission to final examination | | | | | | | | | | | | ▼ |
| 4 | 0 | 0 | Writing Thesis and reports | | | | | | | | | | | | |

Note: Students entering the first year should present a bar chart at least to level 1 of the WBS; for admission to second year, a B-C at level 3 is requested.

### 7.2 PhD Course program management

The program of the PhD Course is organized in a series of events which involve both doctoral students and professors. The following table provides the calendar (Oct-Sept) of the major events.

| Event | Period | Presence of doctoral students | Presence of Professors |
|---|---|---|---|
| Meeting with first year doctoral students | Oct | First year | Coordinator |
| Doctoral student representative election | Oct | All | Coordinator |
| Presentation first year research programs | Oct | All | Course Board and Supervisors |
| Course Board meeting | Oct/Nov* | Representatives | Course Board and Supervisors |
| Lectures | Nov-Jan | Involved students | Involved lecturers |
| Communication about mobility funds availability | ~ Jan | First year | Coordinator |
| Final exam (ordinary session) | Winter / Spring* | Students admitted to the final exam | Coordinator |
| Lectures | Mar-Jun | Involved students | Involved lecturers |
| Training program / Credits update | Mar/May* | Second and third year students | Coordinator |
| Training program / Credits update | June | First year students | Coordinator |
| Course Board meeting | May-Jun | Representatives | Course Board and Supervisors |
| Admission exam | July | | Admission committee |
| Training program / Credits update | Aug/Sept* | All | Coordinator |
| Final exam (extra session) | Autumn | Students admitted to the final exam (with extension) | Coordinator |
| Admissions to 2nd and 3rd year, admissions to final exams | Sept/Nov* | All | Course Board and Supervisors |
| Course Board meeting | Sept/Nov* | Representatives | Course Board and Supervisors |

* Some periods are doubled because of a mismatch between starting dates of different cycles: 28-29th cycle started Jan 2013-2014, 30th cycle started Nov 2014, 31st cycle started Oct 2015.

### 7.2.1 Three-years calendar of the doctoral students major events

| Event | Period | Description and comments |
|---|---|---|
| Introductory meeting | Oct I | Presentation of the STMS PhD Course by the Coordinator |
| Risk assessment form | Oct I | Submission of the risk assessment form |
| Approval of personal training plan and research proposal | Oct I | At least one week before the meeting of the Course Board should be given the documents required for the approval of the training plan and of the proposed research<br>Presentation of the proposed research program |
| PhD student representative elections | Oct I | |
| Safety course (TBC) | Dec I | Demonstration of having passed the on-line safety course |
| Lectures | Nov-Feb I | |
| Lectures | Mar-Jun I | |
| Update of personal training plan | June I | After the end of the courses PhD students have to deliver to the Curriculum Board the complete personal training plan |
| Admission to second year | Sept I | All the required documentation for the admission to the second year has to be delivered at least one week in advance the Course Board meeting<br>Presentation of the research activity done during the first year |
| Doctoral student representative election | Oct II | |
| First year student presentation | Oct II | Participation is advised |

| Event | Period | Description and comments |
|---|---|---|
| Update of personal training plan | Feb II | |
| Lectures | Nov-Feb II | Modules not attended during first year |
| Lectures | Mar-Jun II | Modules not attended during first year |
| Admission to third year | Sept II | All the required documentation for the admission to the third year has to be delivered at least one week in advance the Course Board meeting<br>Presentation (in English) of the research activity done during the second year |
| Doctoral student representative election | Oct III | |
| First year student presentation | Oct III | Participation is advised |
| Update of personal training plan | Feb III | It is required that the minimum number of ECTS credits in educational activities (30) has to be reached within Feb III |
| Possible request of Doctor Europaeus "mention" or of extension of thesis delivery | TBD | |
| Admission to final exam or to the requested extension period | TBD | All the required documentation for the admission to the final exam or for the extension has to be delivered at least one week in advance the Course Board meeting<br>Presentation (in English or other agreed foreign language) of the research activity done during the whole PhD period |
| Delivery of the thesis to the evaluators | TBD | The thesis has to be essentially complete |
| Delivery of the thesis to the reviewers (for the Doctor Europaeus "mention") | TBD | The thesis has to be at a suitable level for an international review |
| Delivery of the student record book and of thesis first page | TBD | After admission to the final exam, for the signatures of Coordinator and Supervisor |
| Delivery of Course evaluation form | Oct III | |
| Delivery of the thesis | TBD | |
| Final exam | TBD | Thesis discussion with an external Board |
| For doctoral students requiring extension: All events related to the final exam and the thesis are shifted by 6 months | | |
| For doctoral students requiring further extension: All events related to the final exam and the thesis are shifted by 12 months | | |

If a doctoral student cannot attend an official event, he/she has to send in advance a justification to the Secretary and the Coordinator for approval. In case of absence due to force majeure, the student is required to notify the Coordinator as soon as possible. In particular, an absence to the event where the presentation for admission to the following year of the doctorate has to be held can be justified only in case of illness or prolonged stay abroad. In this case, the student supervisor must make a presentation of the activities on behalf of the student. The absence to the event where the presentation for admission to the final exam has to be held will be considered case by case.

### 7.2.2 Documentation needed for formal approvals

Doctoral students have to provide the following documentation in electronic format if not differently stated to the Course Secretary.

| Approval | Required Documentation |
|---|---|
| Admission | - Risk assessment form (original)<br>- Analytical report, including personal training plan<br>- Presentation of the proposed research program |
| Admission to second year | - Updating of the analytical report, approved by the supervisor; it has to include the personal training plan demonstrating the achievement of at least 9 ECTS credits<br>- Complete index of the thesis<br>- Declaration of updating the CINECA personal site<br>- Request to write the thesis in English (or other agreed foreign language)<br>- Presentation of the work done in the first year |
| Admission to third year | - Updating of the analytical report, approved by the supervisor; it has to include the personal training plan demonstrating the achievement of at least 21 ECTS credits and of passing all interdisciplinary course exams; last term for modifications to be approved by the Curriculum Board<br>- Description of thesis structure<br>- Declaration of updating the CINECA personal site<br>- Presentation in English of the work done in the second year |
| Request of extension | - Updating of the analytical report, approved by the supervisor; it has to include the personal training plan demonstrating the achievement of at least 30 ECTS credits and of passing all foreseen exams<br>- Description of thesis structure<br>- Declaration of updating the CINECA personal site<br>- Presentation in English of the work done in the third year (or of extension period, if any) |
| Admission to final exam | - Updating of the analytical report, approved by the supervisor; it has to include the personal training plan demonstrating the achievement of at least 30 ECTS credits and of passing all foreseen exams<br>- Draft of the thesis<br>- Declaration of updating the CINECA personal site<br>- Presentation in English of the work done during the PhD |

Lack of the required documentation might entail not admission to the final exam and even expulsion from the Doctoral Course.

### 7.2.3 Supervisor schedule and list of the documentation

Supervisors also are involved in the Course activities: their tasks follow the doctoral student activities and the main events are summarized in the following table.

| Activities | Period | Required documentation |
|---|---|---|
| Approval of the research programs proposed by first year doctoral student | Oct I | Approval of analytical report |
| Non-Disclosure Agreement | Oct I | (Only if required) |
| Admission of doctoral student to second year | Sept I | Approval of analytical report and of thesis index. Short doctoral student evaluation (max 10 lines e-mail). |

| Activities | Period | Required documentation |
|---|---|---|
| Admission of doctoral student to third year | Sept II | Approval of analytical report and of thesis structure description. Short doctoral student evaluation (max 10 lines e-mail). |
| Admission of doctoral student to final exam | Sept III | Approval of analytical report and of thesis draft. Final doctoral student evaluation. |
| Admission of doctoral student to required 6-month extension period | Sept III | Approval of analytical report and of thesis structure description. Short doctoral student evaluation (max 10 lines e-mail). |
| Indication of two reviewers for thesis evaluation | TBD | |
| Proposal of members for final exam Committee | TBD | |
| Signature of thesis front page and of final student evaluation form | TBD | |
| For doctoral students in extended period: All events related to the final exam and the thesis are shifted by 12 months | | |
| For doctoral students in further extended period: All events related to the final exam and the thesis are shifted by 12 months | | |

### 7.2.4 Coordinator schedule

The Course management foresees periodic activities, listed in the following table.

| Event | Period | Activity |
|---|---|---|
| Courses calendar definition | Oct | |
| Meeting with first year doctoral students | Oct | |
| Election of doctoral students representatives | Oct | |
| Course Board meeting | Oct | |
| Proposal of evaluators for Doctor Europaeus (28$^{th}$ cycle) | Oct | |
| Final exam (28$^{th}$ cycle) Committee Proposal | Oct | CINECA forms to fill |
| Course Board meeting | Dec | |
| Signature of booklet, of thesis front page and of final student evaluation form (28$^{th}$ cycle) | Dec | |
| Update on mobility fund availability | Jan | |
| Proposal of Curricula and Course activation for next cycle | Jan | CINECA forms to fill |
| Application to Cariparo PhD grant Call | Apr | |
| Proposal of members for Foreign Cariparo Call Committee | Apr | |
| Proposal of members for next admission exam Committee | Apr | |
| Activation of next PhD cycle Call (“Anagrafe”) | May | CINECA forms to fill |
| Final exam (28$^{th}$ cycle) Committee Proposal (doctoral students in extended period) | May | CINECA forms to fill |
| Admission exam Committee Proposal | May | |
| Course Board meeting | May | |
| Signature of booklet, of thesis front page and of final student evaluation form (doctoral students in extended period) | Jun | |
| Course Board meeting | Jul | |

| Event | Period | Activity |
|---|---|---|
| Foreign candidates evaluation (Cariparo grants Call) | Jun | |
| Admission exams | Jul | |
| Course Board meeting | Sept | |

## 7.3 Management of financial resources

All PhD funds are managed by the Coordinator, in accordance with the procedures established by the University: they are mainly dedicated to cover the mobility of doctoral students, of the Coordinator and other educational activities activated by the Course.
The Coordinator communicates to first year doctoral students what resources are available to each of them for covering their mobility expenses.
In addition to these funds, each PhD student has available for his research during second and third year a personal fund corresponding to 10% of this annual grant (i.e. 1364 €/year). Following the University Rules, allowed expenses that can be covered with these personal funds are:

- Travel
- Conference/seminar fees
- Consumables for research activities (i.e. where it not possible to put the inventory label)
- Publication expenses
- Specific educational expenses finalized to research (for example, language courses)

The amount of money not spent during the second year (with respect to the total available 1364 €) can be spent during the third year. It is strongly suggested to use these personal funds first, and then the PhD ones.
All the expenses have to be authorized by the Coordinator. For all administrative questions and for requesting mission authorization it is requested to contact in advance the CISAS administration.

## 7.4 Miscellanea

### 7.4.1 Non-Disclosure Agreement

In case the supervisor considers the subject of the PhD student research a topic that either needs to be copyright protected or cannot be made totally or partially public, he/she can propose the PhD student to undersign a Non-Disclosure Agreement (see Appendix 8.9). This has to be clearly stated by the supervisor since the very beginning of the research activity, to avoid any possible misunderstanding.

### 7.4.2 Safety

All doctoral students are considered as University employees for what concerns their safety at work. As such, they all have to attend the on-line safety course, and to pass the final exam. For all information, please look at the https://elearning.unipd.it/servizioformazione/ web site (TBC).
All doctoral students who have access to any laboratory have to be properly instructed by the safety lab appointed (in Italian, “preposto”) with dedicated safety courses.

### 7.4.3 Risk assessment

All doctoral students have to fill at the beginning of their PhD activities a risk assessment form. This form can be found in Appendix 8.10. The form has to be filled in and sent to the Course Secretary as soon as the PhD activities start.

### 7.4.4 External working activities

Doctoral students can make temporary external work activities if they are compatible with the foreseen full time PhD study and research commitments. These activities have to be approved by the Course Board. In Appendix 8.11 the template for asking this permission to the Course Board can be found.

### 7.4.5 Evaluation of the Course

At the end of the third year, students fill in the anonymous questionnaire shown in Appendix 8.12, which is made known to the Course Board.

### 7.4.6 Course Resources

In Appendix 8.13 a list of the resources available to the PhD students for their research activity that can be found in each University Department connected to the Course is provided.

### 7.4.7 Additional information

Students are invited to consult the website of the university (http://www.unipd.it/ricerca/dottorati-di-ricerca) for information regarding:

- PhD Courses and doctoral courses active
- Thesis
- Register the teaching of the students
- Forms
- Taxes
- Economic benefits
- Accidents at work and occupational diseases (INAIL)
- Living abroad (authorization and increase the scholarship)
- Scholarship (mode of delivery and social security deductions INPS information)
- Ranking regional grants
- E-mail (any doctoral student will be assigned an e-mail address)

# 8 Appendixes

Many of the forms listed in the following are available for download on the Course web site (http://cisas.unipd.it/modulistica-forms). All the official requests to the Course Board or to the Course Coordinator, can be sent by email to the Secretary.

**8.1 Syllabi of the courses activated by the STMS PhD Course**

**8.2 Passed exam form**

**8.3 Request of authorization for making educational support activity**

**8.4 Personal training plan**

**8.5 Request of authorization for making research in a foreign institution**

**8.6 Extract from the University Regulations on Doctoral Thesis**

**8.7 Analytical report of the doctoral activities**

**8.8 Evaluation form for the admission to the final exam**

**8.9 Non-Disclosure Agreement**

**8.10 Risk Assessment form**

**8.11 Request of authorization for temporary external job**

**8.12 STMS PhD Course evaluation form**

**8.13 STMS PhD Course resources**

# Syllabi of the courses activated by the STMS PhD Course

**Exploring the solar system and its environment (Prof. Cremonese / Prof. Marzari)**
The course is divided in two sections, in the first one there will be a technical-scientific approach to the space missions and the payload, while the second one will have a theoretical approach to the physical characteristics of the Solar System.
Introduction to the main physical characteristics of the Solar System planets. Introduction and description of the main space missions that explored or will explore the Solar System, from the scientific objectives to the instruments on board. We will discuss some details of some instruments where Padova is strongly involved, related to the future on the Solar System exploration, as BepiColombo, Exomars and JUICE.
Description of the physical characteristics of the Solar System and its formation with some mention to the extrasolar systems. Overview of the planetary magnetic fields and their interactions with the solar wind, and the following formation of the magnetospheres. Study of the non-gravitational forces due to absorption and scattering of the solar radiation.

**Fundamentals of measurements and PC-based applications (Prof. Debei / Prof. Lancini)**
Statistical data: probability distributions (Gaussian, equally likely, Weibull) (outline); functional analysis of a measurement chain (notes), development of time-varying data: frequency analysis, filtering, sampling, aliasing, leakage, function transfer (notes), application examples: a) statistical, b) frequency analysis, c) transfer function and bandwidth.
Measurement system fundamentals and vocabulary. Digital acquisition and signal analysis in time and frequency domain. Measuring in uncontrolled environments and long duration measurements. Results processing principles. Databases and GIS for measurement results.

**Spacecraft Dynamics and Control (Prof. Francesconi / Prof. Lorenzini)**
Two-body problem. Orbits and their geometrical representation. Elliptical, parabolic, hyperbolic orbits, escape velocity. Kepler equation. Orbital maneuvers and Hohmann transfers. Interplanetary trajectories. Flyby and planetary capture. Space systems engineering, space systems elements, space mission phases. Orbit selection, special orbits for Earth missions (repeating groundtracks, sun-synchronous, highly elliptic). Flight segment, preliminary sizing of the electric power subsystem, Telecommunication subsystem, attitude control subsystem, thermal control subsystem

**Space optics and detectors (Prof. Naletto / Prof.ssa Pelizzo)**
Fundamental of optics, basic optical components, optical systems design and ray-tracing, perfomances evaluation, imaging instruments, spectroscopic instruments, example of space instruments design, realization and testing.
Photoemission detectors: Photoelectric effect; Quantum efficiency; Photocathode, photomultiplier, channeltron, MCP; MCP detectors, single anode and multi-anode readout. Semiconductor detectors: Atomic theory, semiconductors; Photodiodes and HCT; CCD operation and configurations; Passive and active CMOS (APS); Hybrid detectors; Noise; MTF.

**Aerospace propulsion (Prof. D. Pavarin / Prof. M. Manente)**
Description at sub-system level of Chemical propulsion system, Tsiolkovsky equation. Performance parameters, specific impulse, system specific impulse. Characteristic velocity. Nozzle simplified equations, converging divergin nozzles, pressure profile within the nozzle, nozzle performances at different altitude. Solid rocket motors, general description, main components, equilibrium pressure, main operative parameters, erosive combustion. Liquid Rocket Motors, main components, pressurization systems. Electric propulsion, plasma propulsion, low thrust conditions, Tsiolkovsky equations in case of low thrust conditions, electro-thermal, electrostatic and electromagnetic propulsion systems.

**Mechanical and thermal properties of material for aerospace constructions (Prof. Galvanetto / Prof. Zaccariotto)**

Composite materials are finding an increasing use in the engineering fields where high specific properties (strength/weight, stiffness/weight) are required. Airplanes and spacecraft are typical structures in which the need of weight reduction makes composite materials very convenient.

The lecture course is more concerned with the structural aspects of the use of composites and therefore it provides the preliminary elements for the structural design of structures made with heterogeneous materials and for the evaluation of their strength and stiffness.

The second part of the lectures will cover the structural design of instruments for space applications, definition and identification of main external /internal loads, resistance criteria for metallic, optical glasses; study of the expected thermal and mechanical disturbances during a space mission, methods of thermo-mechanical optimization for the reduction of disturbance effects.

# Passed exam form

The undersigned Prof. ..... states that the doctoral student ....., student code (matricola) ..... has positively passed the exam of the ..... course, with a grade …… (A being the highest, D being not sufficient).

Type of exam:

[ ] written test

[ ] colloquium

[ ] project work

[ ] seminar held in foreign language (not Italian)

[ ] academic lecture

[ ] other (please, specify): .....

The course is:

[ ] activated by the STMS PhD Course

[ ] activated by the doctoral Course of .....

[ ] activated by the bachelor/master Course of .....

[ ] other (please, specify): .....

Having passed this exam, the student acquires ..... credits (either ECTS or CFU).

Date: .....

Signature.....

## Request of authorization for making educational support / tutoring* activity

I undersigned *Name Surname*, PhD student of *Number* cycle Curriculum *MMIS/STASA* ask to the PhD Course Board the authorization to participate to the selection Call for making paid educational support /tutoring* activity for the course *Name of the Course* held by Prof. *Name Surname* for the Graduation course in *Name of the Graduation Course*. The foreseen number of hours is *NNN*.
My supervisor, Prof. *Name Surname*, approves this activity.

Date: DD MM YYYY

Signature: *Name Surname*

Lo/a studente/ssa di dottorato *Nome Cognome* del *NNN* ciclo, curriculum *MMIS/STASA* chiede al Collegio del Corso l'autorizzazione a partecipare al bando di selezione per svolgere attività retribuita di didattica integrativa / tutorato* per il corso di *Titolo del corso* il cui titolare è il Prof. *Nome Cognome* per il Corso di Laurea / Laurea Magistrale in *Nome del Corso di Laura*. Il numero di ore di attività previsto è *NNN*.
Il mio supervisore, Prof. *Nome Cognome*, approva questa attività.

Data: GG MM AAAA

Firma: *Nome Cognome*

* Please, clearly specify if the activity is either "educational support" (didattica integrativa) or "tutoring" (tutorato), having in mind that the first case is limited to maximum 40 hours/year.

**UNIVERSITÀ DEGLI STUDI DI PADOVA**
**Corso di Dottorato in Scienze, Tecnologie e Misure Spaziali**

## PERSONAL TRAINING PLAN OF DOCTORAL STUDENT XXX YYY

| **EDUCATIONAL ACTIVITIES ACTIVATED BY THE STMS PHD COURSE** | | | | | | |
|---|---|---|---|---|---|---|
| **Interdisciplinary Module/Activity** | **Lecturer** | **Expected credits** | **Frequency (YES/NO)** | **Exam (YES/NO)*** | **Date of exam** | **Attained credits** |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| **Curriculum oriented seminars** | **Lecturer** | **Expected credits** | **Frequency (YES/NO)** | **Exam (YES/NO)*** | **Date of exam** | **Attained credits** |
| | | | | | | |
| | | | | | | |
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| **OTHER EDUCATIONAL ACTIVITIES** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the activity (Date/Period/University)** | **Lecturer** | **Duration of activity** | **Expected credits** | **Frequency (YES/NO)** | **Exam (YES/NO)** | **Date of exam** | **Attained credits** |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **Total of expected ECTS credits attainable in educational activities (>30):** | | | | **Total of credits attained in educational activities (at date DD MM YYYY):** | | | |

* Specify which exam will be done as an academic lecture.

## Request of authorization for making research in a foreign institution

The doctoral student Name Surname of NNN cycle MMIS/STASA curriculum asks to the PhD Course Board the authorization to spend the period from ... to ... at the Institute/University in City (State) for making research activities under the supervision of Name Surname. The subject of the research during this period will be .....
The doctoral student supervisor, Prof. Name Surname, supports this request.

[The invitation (letter or e-mail) by the hosting institution is attached.]

Date: DD MM YYYY

Signature: *Name Surname*

Lo/a studente/ssa di dottorato Nome Cognome del NNN ciclo, curriculum MMIS/STASA chiede al Collegio del Corso l'autorizzazione a trascorrere il periodo da … a … presso Istituto/Università a Città (Stato) per svolgere delle attività di ricerca sotto la supervisione di Nome Cognome. L'oggetto della ricerca durante questo periodo sarà ….
Il supervisore, Prof. Nome Cognome, approva questa richiesta.

[Si allega la lettera (e-mail) di invito da parte dell'istituto ospitante.]

Data: GG MM AAAA

Firma: *Nome Cognome*

# Extract from the University Regulations on Doctoral Thesis

***TITOLO IV***
***Conseguimento del Titolo***

**Art.30 - Valutazione della tesi e ammissione all'esame finale**

1. La tesi è valutata da due docenti di elevata qualificazione anche appartenenti a istituzioni estere, esterni ai soggetti che hanno concorso al rilascio del titolo di dottorato, di seguito denominati valutatori.
2. Entro la fine dell'ultimo anno di corso il Collegio docenti dovrà formulare un giudizio sull'attività di ricerca svolta dal dottorando e ammettere il dottorando alla valutazione della tesi da parte dei valutatori.
3. Il dottorando dovrà rendere disponibili ai valutatori:
a) la tesi;
b) il giudizio del collegio;
c) una relazione del dottorando stesso sulle attività svolte durante il dottorato e sulle eventuali pubblicazioni
4. Al fine di ottemperare a quanto previsto dall'art. 8 del DM 45/2013, il competente Servizio di Ateneo coordina una procedura atta a raccogliere i corrispondenti giudizi dei due valutatori esterni e attivare la successiva valutazione di una commissione di esame finale salvaguardando la possibilità del dottorando di poter riformulare la tesi di dottorato in caso di rinvio richiesto dai valutatori.
5. Per comprovati motivi che non consentano la presentazione della tesi nei tempi previsti, il Rettore, previa istanza del dottorando e su proposta motivata del Collegio Docenti può prorogare fino a un massimo di 12 mesi il termine per la presentazione della domanda di esame finale. Le proroghe possono essere richieste esclusivamente per periodi di sei o dodici mesi.
6. L'istanza di proroga deve essere inoltrata al Rettore entro le date che saranno rese note ai dottorandi via web.
7. La proroga non dà titolo alla fruizione della borsa di studio e non comporta alcun onere economico per l'Università degli Studi di Padova, eventuali obblighi di natura assicurativa saranno a carico dell'interessato.
Sarà compito del dipartimento di afferenza definire l'eventuale inclusione in progetti di ricerca o aree tematiche di ricerca del dottorando in proroga che necessiti ulteriormente dell'utilizzo e della frequentazione del Dipartimento e delle sue strutture
8. L'esame finale consiste nella discussione della tesi di dottorato dinanzi alla Commissione di cui all'art. 31.
9. L'eventuale rinvio non dà titolo alla fruizione della borsa di studio e non comporta alcun onere economico per l'Università degli Studi di Padova, eventuali obblighi di natura assicurativa saranno a carico dell'interessato.

**Art. 31 - Commissioni**

1. La nomina della Commissione giudicatrice è disposta con decreto del Rettore su proposta del Collegio dei docenti.
2. Il Collegio dei docenti, ove ne ravvisi la necessità, potrà segnalare più Commissioni in considerazione dei diversi percorsi formativi e di ricerca dei candidati. Le Commissioni di norma non potranno comunque essere più di una per curricolo attivato per il ciclo che si conclude.
3. Le dimissioni dei componenti delle Commissioni devono essere motivate.
4. Le Commissioni giudicatrici sono tenute a concludere le valutazioni entro novanta giorni dalla data del decreto rettorale di nomina. Decorsi i termini suddetti, la Commissione che non abbia concluso i suoi lavori decade ed il Rettore nomina una nuova Commissione, con esclusione dei componenti decaduti.
5. La Commissione giudicatrice di esame finale sarà composta da un minimo di tre a un massimo di cinque membri effettivi e altrettanti supplenti, scelti tra professori, ricercatori universitari o esperti nelle discipline afferenti alle aree scientifiche cui si riferisce il Corso e appartenenti a Strutture di ricerca pubbliche e private, esclusi i supervisori dei dottorandi e i due valutatori della tesi.
6. La commissione, con voto unanime, ha facoltà di attribuire la lode in presenza di risultati di particolare rilievo scientifico

**Art. 32 - Esame finale**

1. La domanda di ammissione all'esame finale dovrà pervenire al Rettore. Al momento dell'inoltro della domanda di esame finale, i dottorandi dovranno essere in regola con il pagamento delle tasse di iscrizione per i tre anni di corso.
2. La domanda di ammissione all'esame finale dovrà essere corredata:
a) della ricevuta dell'avvenuto deposito della tesi in formato digitale nel repository di Ateneo, anche ai fini di adempiere all'obbligo di deposito della tesi presso le biblioteche nazionali di Roma e Firenze;
b) un esemplare cartaceo della tesi per il deposito presso l'archivio dell'Ateneo
c) copia del giudizio analitico scritto sulla tesi dei valutatori con ammissione all'esame finale.
3. I dottorandi dovranno inoltre inviare, non appena sarà stata loro resa nota la composizione della commissione esaminatrice, una copia della tesi corredata dal giudizio dei valutatori a ciascuno dei componenti della Commissione.
4. Le tesi dovranno essere firmate dal Coordinatore del corso e dal Supervisore.
5. La data e il luogo d'esame verranno pubblicati nel sito Web di Ateneo.
6. Al candidato che abbia superato l'esame finale verrà attribuito il titolo di dottore di ricerca e verrà in tal senso rilasciato un diploma che riporterà la dicitura del Corso e dell'eventuale curricolo frequentato.
7. Al termine della discussione la tesi, con motivato giudizio scritto collegiale, è approvata o respinta.

# Analytical report of the doctoral activities

**RESEARCH TITLE (THESIS)**: .....

**DOCTORAL STUDENT**: .....
**e-mail address: .....**

**CURRICULUM**
[ ] Mechanical Measurements for Engineering and Space (MMIS)
[ ] Sciences and Technologies for Aeronautics and Satellite Applications (STASA)

**TYPE OF GRANT**
[ ] University grant
[ ] Ministry of Research (Fondi MIUR sostentamento giovani, ex legge 170) in the field of .....
[ ] Other funding source, free research project. Specify the funding source: .....
[ ] Other funding source, specific research project. Specify both the funding source and the research project: .....
[ ] No grant

**SUPERVISOR**: .....  **CO-SUPERVISOR**: .....

**DEPARTMENT (INSTITUTE) OF REFERENCE: .....**

**EVENT:**
[ ] Presentation of the proposed research program
[ ] Request of admission to the second year of the PhD Course
[ ] Request of admission to the third year of the PhD Course
[ ] Request of admission to the final exam
[ ] Request of extension period for the final exam

**RESEARCH OBJECTIVES AND INTERNATIONAL FRAMEWORK**
Description of the objectives of the research and of the international framework (one page maximum)

**REPORT ON THE ACTIVITIES PROGRAM (description of what has been done and analysis of what has to be done)**
First and second year doctoral students: description of the activities done during the last year (one page maximum). Third year doctoral students: description of the activities done during the whole three-year period (two pages maximum).
Work Breakdown Structure of the research/educational program done and/or foreseen: a) level 1 for the presentation of the research program; b) level 2 for admission to the second year; c) level 3 up for other admissions. Any Work Package (WP) has to be suitably described. Also the time distribution (man-hours, 1500 per year) has to be indicated per each WP and for the educational activities (750 hours total).
GANNT bar-chart of the activities program done and/or foreseen, in agreement with the WBS: a) for the presentation of the research activity a 3-month time scale at the first year, and 6-month time scale at the following two years is required; b) for the admission to the second and third year, a 3-month time scale is required.

**NATIONAL AND INTERNATIONAL COLLABORATIONS**
List of the collaborations done and/or foreseen

**INDUSTRY COLLABORATIONS**
List of the collaborations with industry done and/or foreseen

**PERIODS SPENT ABROAD**
List of the period spent outside of Italy related to the research activity. Specify location and duration.

**FORESEEN AND ACTUAL RESEARCH PRODUCTS**
[ ] new equipment
[ ] new know-how
[ ] publications
[ ] new process
[ ] new methods
[ ] spin-off(s)

**PERSONAL TRAINING PLAN**
Attach here the personal training plan. Describe in this section how it is planned to recover possible delays with respect to the foreseen plan.

**SUPERVISOR APPROVAL**
The supervisor, Prof. ..... approves this analytical report of the activities program.
[NB: For the presentation of the proposed research program this line has not to be filled in, because the supervisor has not been officially assigned yet]

# Evaluation of the PhD student *Name Surname* for the admission to the final exam

**Thesis Title: ……**

**List of attended educational Course activities and of passed exams:**

…….

**List of attended Conferences, Schools, International meeting:**

…….

**Periods spent outside Italy:**

…….

**List of publications:**

…….

**Research outputs (i.e. new equipment, processes, know-how, methodologies, spin-offs, …):**

…….

**Other scientific/academic/industrial commitments during the PhD period:**

…….

**Evaluation of the Thesis Work:**

……. *(to be filled in by the Supervisor)*

**Evaluation of the PhD student attitude about possible future activities in an academic or non academic environment**

……. *(to be filled in by the Supervisor)*

**Other comments:**

……. *(to be filled in by the Supervisor)*

The Supervisor: Prof. *Name Surname*

The Curriculum Coordinator: Prof. *Name Surname*

The Course Coordinator: Prof. *Name Surname*

Approved by the PhD Course Board on: …. *(type the date of the Course Board admission meeting)*

**DICHIARAZIONE DI RISERVATEZZA**
**E**
**DI RICONOSCIMENTO DEI DIRITTI DI UTILIZZAZIONE DELLA PROPRIETÀ INTELLETTUALE**

*[NB da utilizzare solo nel caso in cui il Supervisore del dottorando lo ritenga necessario]*

Il/La sottoscritto/a _____

nato/a a _____ il _____

residente a _____

in Via _____ dottorando/a del _____ ciclo,

dovendo sviluppare una ricerca sull'argomento: _____

_____

sotto la supervisione del/la Prof./ssa _____

SI IMPEGNA

- a garantire in qualunque momento la disponibilità al supervisore dei prodotti della ricerca ottenuti anche grazie alle informazioni e conoscenze rese disponibili dal gruppo di ricerca e altrimenti non reperibili;
- a mantenere la riservatezza su informazioni e conoscenze che gli verranno messe a disposizione dal gruppo di ricerca per lo svolgimento dell'attività di ricerca durante il dottorato e la redazione della tesi di dottorato, qualora gli venga esplicitamente dichiarato che si tratta di informazioni riservate;
- ad utilizzare queste informazioni ai soli fini dell'elaborazione e, se necessario, discussione in pubblica seduta della tesi di dottorato, con modalità definite in accordo con il supervisore che non possano essere comunque di pregiudizio alla proprietà intellettuale delle stesse.

RICONOSCE

- che la proprietà intellettuale degli eventuali prodotti della tesi di dottorato, quali ad esempio possibili sviluppi scientifico/tecnologici e/o applicazioni industriali, ottenuti anche grazie alle informazioni e conoscenze rese disponibili dal gruppo di ricerca e altrimenti non reperibili, nonché i diritti morali e di utilizzazione anche economica dei risultati relativi, sono condivisi con l'Università degli Studi di Padova secondo la normativa vigente.

Padova, _____

Il/La dottorando/a _____

Firma _____

**Al Servizio di Medicina Preventiva**
**dei Lavoratori Universitari Università degli Studi di Padova**
**Via Marzolo 3/A**

**D I C H I A R O**

Ai sensi e per gli effetti delle disposizioni contenute nel D. Lgs. 81/08, che il sig./ra:

**Cognome** …….. **Nome**……

**Nato a** …… **il** …….. **tel**. .....

**in qualità di:** docente/ricercatore/professore❑ - tecnico/amministrativo❑ - dottorando❑ - specializzando❑ - assegnista❑ - laureando*****❑ - borsista❑ - tirocinante❑ ospite❑ - altro .....❑

**afferente alla struttura: codice** …… **denominazione** ……
*(Dip./ Centro /Servizio ecc.)*

***Data inizio attività**: ...../...../..... **Data di prevista cessazione:** ...../...../.....*

**** in particolare per gli studenti in tesi*** -
Laureando del Corso di Studi in: ……

Relatore:……

**INDIVIDUAZIONE DEI LUOGHI E/O DELLE AREE SEDE DI LAVORO**
(Per l'identificazione fare riferimento ai codici GEOTEC contenuti nelle planimetrie ufficiali di Ateneo)

Edificio (denominazione): …….. Edificio (Codice): ……..Piano: ……. Locale. …….

Locale o Laboratorio (Denominazione):……

Struttura: (denominazione): …… (codice):……
*(Se diversa da quella di afferenza - Dip./ Centro /Servizio ecc.)*

Responsabile del laboratorio: ……

**GLI SPAZI COMPRENDONO (contrassegnare con X):**

Ufficio/studio – Biblioteca e/o archivio - Laboratorio meccanico / officina / falegnameria - Laboratorio Chimico - Laboratorio biologico - Laboratorio informatico - laboratorio con presenza di apparecchiature radiogene o sostanze radioattive - Campi, boschi, terreni – Ambulatorio - Sala Operatoria – Degenza - altro ……

**TIPOLOGIA DI RISCHIO (contrassegnare con X):**

Movimentazione manuale dei carichi - Videoterminale (> 20 ore/settimana) – Rumore – Vibrazioni – Campi elettromagnetici - Radiazioni ottiche artificiali - Agenti chimici - Agenti cancerogeni e mutageni*** *(dati da specificare nella tabella allegata)* □ – Agenti biologici gruppo 1 e 2 □ - Agenti biologici gruppo 3 e 4 ***(dati da specificare nella tabella allegata)* - MOGM □ - Rischio Elettrico - Rischi attrezzature – Radiazioni ionizzanti - Altro ……

****Dati Agenti biologici utilizzati (gruppo 3 e 4)**

| Agente Biologico | Attività Svolta (in breve) | Gruppo (3 o 4) |
|---|---|---|
| | | |
| | | |
| | | |

*****Dati Sostanze cancerogene o mutagene utilizzate (R45;R46;R49, H340, H341, H350, H351)**

| Sostanza o Miscela | N°CAS | Stato Fisico | Concentrazione |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

Data _____ Firma Responsabile/Referente _____

Timbro Dipartimento _____ Firma del Direttore _____

## Request of authorization for temporary external job

Doctoral student *Name Surname* of *Number* cycle Curriculum *MMIS/STASA* asks to the PhD Course Board the authorization to carry out a temporary job external di the PhD Course. The company interested in this activity is *XXX* that would initiate a contract *YYY* (specify the contract type).

I also declare that:
- my supervisor, Prof. *ZZZ*, approves this temporary job;
- the PhD remains my main full time activity, and that this temporary job will be done out of the timeframe foreseen for the PhD, without any consequence on the regular execution of the PhD activities;
- the payment agreed for this temporary job *respects/does not respect* the limitation set in the admission Call for having access to the PhD grants.

Il/la sottoscritto/a *Nome Cognome*, studente di dottorato del *NNN* ciclo, curriculum *MMIS/STASA* chiede al Collegio del Corso l'autorizzazione a svolgere una attività lavorativa temporanea esterna al Corso di Dottorato. L'azienda interessata a questa attività è *XXX* che attiverebbe un contratto *YYY (specificare la tipologia del contratto)*.

Dichiaro inoltre che:
- il mio supervisore Prof. *ZZZ* approva questa attività lavorativa temporanea;
- il dottorato rimane l'attività primaria a tempo pieno, e questa attività lavorativa temporanea sarà svolta nelle ore esterne alla schedula oraria del dottorato senza alcuna ripercussione sul regolare svolgimento delle attività del dottorato;
- il compenso pattuito per questa attività lavorativa temporanea *rispetta/non rispetta* i limiti imposti nel bando di ammissione per la fruizione della borsa di studio.

In addition to this request of authorization, the doctoral student has to send to the PhD Course Board also the approval of this activity by the Supervisor.

# Evaluation of the STMS PhD Course

## QUESTIONNAIRE

1. What was the relevance of the PhD STMS Course imagined when registering for the course for your future career? (Enter a number in the scale of 0 to 10 where 0 means it is a doctorate as others, and 10 indicates extremely relevant)
2. The Course has met your initial expectations ? (Give a number between 0 and 10 where 0 means “not at all”, and 10 means “completely”)
3. How would you rate the supervision and/or assistance of your supervisor ? (Give a number between 0 and 10 where 0 is “non-existent” and 10 being “excellent”)
4. How would you rate the relationship with doctoral students implemented by the Course Coordinator ? (Give a number between 0 and 10 where 0 means “unacceptable” and 10 being “excellent”)
5. How would you rate the relationship with doctoral students implemented by the Course Coordinator? (Give a number between 0 and 10 where 0 means “unacceptable” and 10 being “excellent”)
6. Having in mind the number of 750 hours in three years to devote to educational training program (number set by the Ministry of Education for a doctoral class), how do you assess the course structure adopted by the Course (mandatory lectures, curriculum dedicated courses, seminars, etc.) ? (Give a number between 0 and 10 where 0 is “too rigid and unsustainable” and 10 being “excellent”)
7. How do you rate the lessons of Course teachers, on average? (Give a number between 0 and 10 where 0 means “totally useless” and 10 being “excellent”)
8. How do you rate the degree of interdisciplinary educational activities offered by the Course? (Give a number between 0 and 10 where 0 is “non-existent” and 10 being “high grade”)
9. How do you rate the significance of the course exams ? (Give a number between 0 and 10 where 0 means “irrelevant” and 10 means “very adequate”)
10. Have you had difficulty in disposing of tools, equipment and bibliography necessary for the development of the thesis? (Give a number between 0 and 10 where 0 means “too much” and 10 means “none”)
11. What is your level of satisfaction with the mobility funds made available by the research group you belong to? (Give a number between 0 and 10 where 0 means “completely dissatisfied” and 10 means “very satisfied”)
12. Write any comment you feel important to improve the Course (continued on the back, max 1 page)

## PhD Course Resources

This section lists the main hardware and software resources available in the various Departments to which doctoral students may have access. This list is in continuous evolution, and is meant to convey an idea of the broad spectrum of resources available to the students.

### Department of Industrial Engineering (University of Padova)

- equipment dedicated to testing of space instruments
- clean room of class 100
- dynamical analysis and structures test room
- 3 thermo-vacuum chambers for tests of space components
- laboratory dedicated to fluidoelasticity, servo-manipulators, vibration mechanisms, tribology and diagnostics of machines, equipped with:
- dynamic tests equipment (fatigue, shakers)
- instrumentation for noise and vibration analyses
- small subsonic wind tunnel
- anemometers, Pitot manometers
- Laser
- Stroboscopes
- data logger for strain gages, temperature sensor
- vision system for dimensional measuring
- pneumatics, hydraulics, electrical actuators PLC
- microprocessors for control and simulator
- computing facilities:
- several PC and servers; connection with University computer center and CINECA complex;
- software packages: ESATAN, I-DEAS, ESABASE, GUERAP, NASTRAN, MARC, for structural and thermal analyses and space data base

### Department of Information Engineering (University of Padova)

- M3.5/M4.5 clean room (35 square meter) equipped with laminar bench (M3.5), optical bench and Zygo interferometer
- One cubic meter high vacuum chamber with electrical feedthrough for testing and calibrating flight instrumentation; it is interfaced with the clean room
- Normal incidence monochromator for characterizing optical elements and detectors in the 30-500 nm spectral region
- Grazing incidence monochromator for the 1-30 nm spectral region
- High vacuum system for reflectivity measurements in the EUV and soft X spectral region
- Vacuum deposition system
- High vacuum system for testing on photon counting detectors
- X-ray source (2-60 keV), Manson X-ray source (0.1-25 nm), hollow cathode source (20-200 nm), deuterium source, several spectral lamps
- MAMA and delay line detector for photon counting in the EUV
- Several CEMs, operating both in analog and photon counting regimes
- Intensified CCD camera, several CCD cameras from X-ray to near IR
- Calibrated photodiodes to operate in the 0.1-1100 nm
- Cary V spectrophotometer
- Solar simulator
- Pico ammeter

- Quadrupole for gas residual analysis
- Oscilloscopes
- Several different lasers: Nd, Ar+, excimer, Nd-YAG

### Department of Physics and Astronomy (University of Padova)

- Telescopes in Asiago: 122 cm, 182cm 67/92 Schmidt.
- Several spectrographs of low and medium resolution, with CCD detectors. Imaging Camera with CCD detector.
- Access to 3.5m TNG in Canary Islands, to ESO Telescopes in Chile.
- Computing facilities
- Local network connected to the University computer center, CINECA and Asiago.
- Software packages: MIDAS, IRAF, VISTA, IDL, LSQR, JPL ephemeris, CLEAN, MATHLAB, CODE-V, ESABASE.

### Department of Geosciences (University of Padova)

- software packages: Bernese 5.0, Spidernet(Leica), EuroNet (Euronik), Matlab con Map Module, COMSOL (elementi finiti) con modulo di meccanica strutturale, compilatori Fortran Lahey Fortran 95 e Borland Visual C++
- GPS antenna/receivers (Permanent GPS network of Veneto)
- PIXE equipment for aerosol analyses, APM_elecos for aerosol sampling (it worked in Antarctica);

### Mechanical and Industrial Engineering Department (Brescia)

- Post Rig/Vehicle motion simulator for multi-axial vibration test
- Electrodynamic shaker
- Reconfigurable acquisition system for high performance applications
- Mechatronics Lab
- Robotics Lab

### Department of Mechanical and Structural Engineering (Trento)

- Coordinate Measuring Machine CMM
- Robot manipulator
- Thermal Vacuum chamber TV
- fiber Bragg sensor interrogator
- a system for image processing in Real Time - NI CVI
- Agilent multi-sensor conditioning system
- 4 channel oscilloscope 5 GSamples/s - Yokogawa

### Department of Industrial Engineering (Perugia)

- Thermoelasticity measurement system Stress Photonics Delta Therm 1560, pyrometer
- 2 lock-in EG&G amplifier and 2 filter set EG&G
- 2 Ometron Spate 9000 heads
- Agema 900 thermography
- Strani Gauge, installation kit, tester and Vischi signal conditioning system
- Thermocouples, thermo-resistance, digital thermometers,
- Data acquisition system for thermocouples 8 channels (PC board)
- Power meter Newport, kit for fiber optic assembly RS, photodiodes, laser diodes, optical fibers and connectors, laser He-Ne, optical table, fiber optic collimators, fiber couplers, etc.
- Optical fiber strain gauges FBG and MicronOptics interrogation system
- Image acquisition and processing system (NI board, Dalsa camera, PC)

- Contact pressure measurement system by Novel
- LMS with Scadas III measurement and processing system for modal analysis
- Accelerometers, load cell, 3 PCB hammers, 3 proximity
- Test bench for little electric motors testing
- Hydraulic test rig for flow meter calibrations
- Test bench for hydrophone analysis of leakage
- Electrodynamics test bench equipped with shaker Ling - LDS 1600 N
- Shaker B&K 4810
- test bench of gears by thermoelasticity
- test bench of specimen by thermoelasticity
- Spectrum analyzer ONO-SOKKI, oscilloscopes, multimeters, milli-ohmeter, signal generators Hameg
- Data acquisition cards  National Instruments AT-MIO-16 DE 100 Ks/s, oscilloscope/analyzer of spectrum bi-channel for PC type PICO