


Allegato 3 - Planning and organization document for training and research activities (DPO)

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PhD Course in “Energy and Sustainable Development”

Reference department: CIRIAF – BIOMASS RESEARCH CENTRE SECTION (CRB)

Location: CIRIAF – BIOMASS RESEARCH CENTRE SECTION (CRB)

Other info: the PhD course is based in the Biomass Research Centre section of an inter-university research centre (CIRIAF), which has its administrative headquarters at the University of Perugia

Training activities calendar (D.PHD.2.1)

List of organized courses:

1. Lecturer: Prof. Beatrice Castellani (member of PhD Board)
SSD: ING-IND/10
Title: Energy storage: state of the art and in-lab experimental investigations
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 1
Reference curriculum: both
2. Lecturer: Dr. Francesca Merli (expert from the academic community)
SSD: ING-IND/11
Title: Innovative aerogel-based glazing systems for building applications
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 1
Reference curriculum: Energy and environmental well-being
3. Lecturer: Dr. Paolina Bongiannini Cerlini (expert from the academic community)
SSD: ING-IND/11
Title: Introduction to Atmospheric Physics, Climate and COPERNICUS DATA STORE (CDS)
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 1
Reference curriculum: Energy, agricultural and territorial resources
4. Lecturers: Dr. Claudia Fabiani and Dr. Ilaria Pigliautile (experts from the academic community)
SSD: course of general topic, involving all PhD SSDs
Title: An Introduction to Error Analysis
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 1
Reference curriculum: both
5. Lecturers: Prof. Francesco Fantozzi (member of PhD Board) and Dr. Pietro Bartocci (expert from the academic community)
SSD: course of general topic, involving all PhD SSDs
Title: LCA – Life Cycle Assessment
Hours: 20 frontal hours, total commitment of the student equal to 60 hours

ECTS: 10

Year: 1

Reference curriculum: both

6. *Lecturer: Dr. Elisa Belloni (expert from the academic community)*
SSD: ING-IND/33
Title: Renewables Storage, and Energy Communities: New actors of the electrical power systems
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 2
Reference curriculum: Energy and environmental well-being
7. *Lecturer: Dr. Valentina Coccia (expert from the academic community)*
SSD: ING-IND/11
Title: Evaluation and measurement of odour emissions using dynamic olfactometry with a panel of human receptors
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 2
Reference curriculum: Energy and environmental well-being
8. *Lecturer: Prof. Gianluca Cavalaglio (expert from the academic community)*
SSD: ING-IND/10
Title: Green chemistry applications for bioenergy and bioproducts plants
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 2
Reference curriculum: Energy, agricultural and territorial resources
9. *Lecturer: Prof. Aurelio Stoppini (member of PhD Board) and Dr. Laura Marconi (expert from the academic community)*
SSD: ICAR/06
Title: Open Source GIS for the analysis and sustainable development of the territory
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 2
Reference curriculum: Energy, agricultural and territorial resources
10. *Lecturers: Dr. Claudia Fabiani and Dr. Ilaria Pigliatulle (experts from the academic community)*
SSD: course of general topic, involving all PhD SSDs
Title: Applied statistics for experiment design and data analysis
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 2
Reference curriculum: both
11. *Lecturer: Prof. Angela Gambelunghe (member of PhD Board)*
SSD: MED/44
Title: Radioprotection from exposure to ionizing radiation
Hours: 20 frontal hours, total commitment of the student equal to 60 hours
ECTS: 10
Year: 2
Reference curriculum: Energy and environmental well-being

It is possible that a student of one curriculum may follow a course that refers to a different curriculum, subject to the approval of his/her supervisor. Courses that refer to a PhD year can also be followed by students of different PhD years, with the approval of his/her supervisor.

Specific seminars:

Specific seminars are also organized, duration from 2 to 4 hours, by national expert lecturers in the sector, on topics such as hydrogen, energy transition, innovations in the field of renewable energies, sustainable process and product design, innovative energy systems, sustainable and circular business models, indoor air quality and health effects, indoor and outdoor comfort in the built environment, innovative theories and experimental facilities, innovative solutions in the field of thermal and electrical storage, analysis of territorial risks, use of agricultural resources in the energy sector, GIS georeferencing, concepts of sustainability in building renovation, assessment of sustainable development. These seminars provide for the recognition of 1 credit each and are organized on average every four months (3 per year).

Workshops and seminars will also be organized with foreign members of our PhD Board and other international experts, to be defined according to their availability, on topics such as urban heat island mitigation, energy storage in the civil and industrial sector, materials and innovative solutions for thermal insulation, biofuels, renewable resources, georeferencing, planning in the territorial and agricultural fields. These international seminars provide for the recognition of 2 credits each; 2 seminars/year (semestral) are typically organized.

In the context of collaborations with members of PhD Board and European PhD projects (e.g. INPATH-TES and MuSIC) in which CIRIAF has been involved and is involved, packages of lessons held by expert lecturers on the PhD topics are also continuously offered.

Other scientific events:

A scientific event of national relevance to which all PhD students are invited to participate is the CIRIAF National Congress, which is held every year in April, and which allows to obtain 1 ECTS for participation, 4 ECTSs if the student presents a paper in a thematic session regarding the results of his/her carried out research activities.

Integration of PhD students in the scientific community (D.PHD.2.2)

Training events for exchange/presentation of research results:

Once a year, there is a training session for the exchange and presentation of the results of the research carried out by the PhD students, in the presence of the members of the PhD Board.

Participation in national and international congresses and/or workshops:

The supervisors will propose to their PhD students, for each year of the course, participation in national and/or international conferences or scientific workshops in the sector in which the research activity is focused. In this regard, each PhD student will be invited to write a paper for the congress or workshop (at least 3 in the three-year period), and, also in order to stimulate his autonomy in the research dissemination, participation will be proposed as speaker, which will allow the acquisition of 4 ECTS/paper, even in remote or mixed modalities.

Participation in national and international training schools:

Each PhD student is also invited to participate in training schools (e.g. Summer School, Winter School, ...) in the sector in which he is carrying out the research (0.3 schools/year per PhD student, i.e. 1 school in the three-year PhD period).

Autonomy of the PhD student (D.PHD.2.3)

Activities organized to develop the autonomy of the PhD student in conceiving, planning, implementing and disseminating research and/or innovation programmes:

In the first year, there will be meetings (at least every two weeks), also online, between the supervisor and the PhD student, in which the supervisor himself will have the aim of stimulating the student's innovative

proposals; the meeting has the purpose of making these ideas operational, initially optimizing them thanks to the experience and competence of the supervisor. In the second and third year, these meetings may be reduced to a monthly basis, in order to further develop the autonomy of the PhD student in carrying out the research programme. To this aim, opportunities for travel and stays abroad at universities, research centres or companies will also be proposed in the three-year PhD period for the acquisition of further skills and autonomy, to be considered preferably implemented during the second year, assuming having to devote the third year to writing the thesis and related original contributions.

Presence of members of the PhD Board, external supervisors of national/international and/or professional relevance who carry out support and guidance functions:

Each PhD student will be guided by a supervisor and one or more co-supervisors, at least one of whom belonging to the PhD Board. These supervisors have a relevant expertise (at least nationally), while support functions may also be performed by professors of foreign universities, such as the ones belonging to the PhD Board, who have a high expertise at an international level (one of the international members of the PhD Board received a Nobel Prize in Physics in 2014).

Presence of a co-supervisor within the company for industrial doctorates:

For industrial doctorates, an individual within the company is expected to be the supervisor or co-supervisor, in order to quickly solve any problems of the working student (a member of each partner company is a member of the PhD Board).

Modalities for choosing the supervisor and maximum number of assigned PhD students:

The PhD course in "Energy and Sustainable Development" is open to master's graduates of any background, given the multidisciplinary nature of the covered topics. Thus, the supervisors are identified on the basis of the consistency between members of the PhD Board and the PhD student's degree training; the coherence of this association with the PhD student's training can be further obtained by identifying a specific support co-supervisor in the academic or industrial world, whose appointment is shared within the PhD Board, on the proposal of the supervisor. A maximum number of assigned PhD students is not indicated for each supervisor or co-supervisor, in order to ensure that the PhD Board members are not demotivated to find funding for doctoral scholarships after having reached the limit (usually, the Board member who makes available a specific grant for a doctoral scholarship is also supervisor or co-supervisor of the future PhD student).

Financial and structural resources (D.PHD.2.4)

Resources provided by the University:

Each PhD student has financial resources provided by the University of Perugia, in particular:

- an annual amount equal to 10% of the scholarship (for all PhD students, even without scholarship and industrial ones), to be used for research activities (purchase of materials, equipment, travels, participation in congresses) and available in 1st year since XXXVIII cycle;
- a 50% increase in the scholarship for stays abroad at universities, research centres or companies.

Resources provided by the Department and/or by the supervisors:

Additional financial resources may be made available by the supervisors through their own research funds (of the Department or Research Centre to which they belong to) if the PhD student participates in funded research projects for which the supervisors themselves are responsible.

Operative and scientific structures available to PhD students:

In order to guarantee the correct development of the training and research activities, tools and equipment from CIRIAF (the research centre which organizes the course) laboratories are available to PhD students, in particular:

- Biomass Characterization Lab
- Biofuels and biochemicals Lab

- Laboratory of technologies for renewable energies, energy efficiency and sustainable development (also located at the branch of S. Apollinare)
- Olfactometry Lab
- Acoustics Lab
- Thermotechnics Lab
- Laboratory of Environmental Controls
- Environmental Applied Physics Lab.

Three classrooms are also available at the CIRIAF headquarters for training activities.

Other tools and equipment can also be used by students, as they are available to some members of the PhD Board, from the Labs of Machinery (pyrolysis, calculation centre, fluidized bed reactor), Quality control in the agri-food sector, the DBVPG Industrial Yeast Collection, Occupational Medicine and Environmental Professional Toxicology, Geotechnics, Topography and Photogrammetry.

Other resources consist of a significant collection of books (Biomass Research Centre Library, CIRIAF Library, Engineering Pole Library, Bio-Medical Library), University online subscriptions to national and international scientific journals, access to specific databases (on chemical-physical and energy properties of biomass, on thermal and acoustic insulation properties of fixtures and building materials and components).

Finally, numerous software are available for numerical simulations and analytical evaluations in the fields of the various proposed topics, such as Ansys-Fluent (thermo-fluid-dynamics and structural analysis), Design Builder (building/plant thermo-physics), Star (thermo-fluid-dynamics), ASPEN (simulation of chemical processes), Sima Pro and OneClickLCA (LCA), MC4-HVAC-CAD (building energy), TRACE-PRO (photometry, lighting), Ramsete (architectural acoustics), Sound Plan (acoustics), Matlab, ArchGis, Meteonorm, Comsol Multiphysics.

For an adequate performance of the activities, consistent with the objectives set, each PhD student is therefore guaranteed:

- a workstation with a desk equipped with a PC and internet connection;
- access to the laboratories mentioned above;
- the possibility of using the above mentioned software and the relative calculation stations.

Teaching and tutoring activities (D.PHD.2.5)

Each PhD student is allowed to carry out supplementary teaching or tutoring activities consistent with the research project, for a maximum of 40 hours per year and agreed with the supervisor. 1 credit is associated with these activities for every 2 carried out frontal hours (every 2 frontal hours are considered equal to a total commitment of 6 hours by the PhD student).

Scientific reports and PhD student mobility (D.PHD.2.6)

Presence of co-tutelle and/or multiple PhDs:

Co-tutelle PhDs are possible with foreign universities that have collaborations or collaborate with CIRIAF or members of the PhD Board, to be activated through a specific agreement in the first year of activity. Co-tutelle PhDs allow for the issue of joint doctoral degrees.

Duration of periods of compulsory mobility of doctoral students at qualified academic and/or industrial institutions or at public or private, Italian or foreign research institutions:

Some PhD scholarships (e.g. scholarships financed with PNRR funds) provide for periods of compulsory mobility (even remotely if suitably justified) of at least 6 months at qualified academic and/or industrial institutions or at foreign public or private research institutions, to be identified in collaboration with the supervisor on the basis of the project awarded the scholarship funding. For the other doctoral scholarships, a similar mobility period of at least 6 months at qualified academic and/or industrial institutions or at foreign public or private research institutions is strongly recommended, also to be identified in collaboration with the supervisor.

Research products (D.PHD.2.7)

It is expected that credits will be obtained for each publication, in particular:

- publication in Scopus and/or WOS indexed scientific journal: 4 credits

- other Scopus and/or WOS indexed publications: 2 credits
- other non-indexed publications: 1 credit

It is also expected that 4 credits will be obtained for each obtained patent.

At least 2 publications in internationally relevant scientific journals and 3 in conference proceedings are expected from each PhD student in the three-year period, preferably presented by the same PhD student at international congresses (even remotely). It is suggested that the research activities considered of particular scientific importance, also on the indication of the supervisor, are submitted to a scientific journal in the first quartile of the reference sector.