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

A.D. 1308 unipg UNIVERSITÀ DEGLI STUDI DI PERUGIA	**Planning and organization document for training and research activities (DPO)**	**MODOT AQ 3** **Rev.5** **Date: 12/03/2024**

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/11
   Title: Energy storage: state of the art and in-lab experimental investigations
   Hours: 24 frontal hours
   ECTS: 4
   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: 24 frontal hours
   ECTS: 4
   Year: 1
   Reference curriculum: Energy and environmental well-being

3. *Lecturer: Dr. Paolina Bongioannini Cerlini (expert from the academic community)*
   SSD: FIS/01
   Title: Introduction to Atmospheric Physics, Climate and COPERNICUS DATA STORE (CDS)
   Hours: 24 frontal hours
   ECTS: 4
   Year: 1
   Reference curriculum: Energy, agricultural and territorial resources

4. *Lecturers: Dr. Claudia Fabiani (course manager) and Dr. Ilaria Pigliautile (co-teaching)*
   (experts from the academic community)
   SSD: ING-IND/11
   Title: Error analysis and experiment design in material characterization and energy assessment
   Hours: 24 frontal hours (12 hours Dr. Claudia Fabiani, 12 hours Dr. Ilaria Pigliautile)
   ECTS: 4
   Year: 1
   Reference curriculum: both

5. *Lecturer: Prof. Francesco Fantozzi (member of PhD Board)*
   SSD: ING-IND/08
   Title: LCA – Life Cycle Assessment
   Hours: 18 frontal hours

ECTS: 3
Year: 1
Reference curriculum: both

6. *Lecturer: Prof. Manuela Cecconi (member of PhD Board)*
   SSD: ICAR/07
   Title: In situ investigations and instrumentation for site assessment
   Hours: 18 frontal hours
   ECTS: 3
   Year: 1
   Reference curriculum: Energy, agricultural and territorial resources

7. *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: 18 frontal hours
   ECTS: 3
   Year: 1
   Reference curriculum: Energy and environmental well-being

8. *Lecturers: Prof. Anna Laura Pisello (member of PhD Board – course manager) and Dr. Ilaria Pigliautile (co-teaching - expert from the academic community)*
   SSD: ING-IND/11
   Title: Multidomain comfort for energy saving and personalized wellbeing in the built environment
   Hours: 24 frontal hours (12 hours Prof. Anna Laura Pisello, 12 hours Dr. Ilaria Pigliautile)
   ECTS: 4
   Year: 2
   Reference curriculum: Energy and environmental well-being

9. *Lecturer: Dr. Valentina Coccia (expert from the academic community)*
   SSD: ING-IND/10
   Title: Evaluation and measurement of odour emissions using dynamic olfactometry with a panel of human receptors
   Hours: 24 frontal hours
   ECTS: 4
   Year: 2
   Reference curriculum: Energy and environmental well-being

10. *Lecturer: Prof. Gianluca Cavalaglio (expert from the academic community)*
    SSD: ING-IND/10
    Title: Green transition applications for renewable energy and bioproducts plants
    Hours: 24 frontal hours
    ECTS: 4
    Year: 2
    Reference curriculum: Energy, agricultural and territorial resources

11. *Lecturer: Prof. Aurelio Stoppini (member of PhD Board)*
    SSD: ICAR/06
    Title: Open Source GIS for the analysis and sustainable development of the territory
    Hours: 18 frontal hours
    ECTS: 3
    Year: 2
    Reference curriculum: Energy, agricultural and territorial resources

12. *Lecturers: Dr. Ilaria Pigliautile (course manager) and Dr. Claudia Fabiani (co-teaching)*
    (experts from the academic community)
    SSD: ING-IND/11
    Title: Applied statistics for energy and environmental analysis
    Hours: 24 frontal hours (12 hours Dr. Ilaria Pigliautile, 12 hours Dr. Claudia Fabiani)
    ECTS: 4
    Year: 2
    Reference curriculum: both

13. *Lecturer: Prof. Angela Gambelunghe (member of PhD Board)*
    SSD: MED/44
    Title: Radioprotection from exposure to ionizing radiation
    Hours: 18 frontal hours
    ECTS: 3
    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 6 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 involve the allocation of 1 credit for every 6 hours and are typically organized every four months (3 times a 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 1 credit for every 6 hours; 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 0.5 credits for each day of participation, and where the PhD student is invited to present a paper in one of the thematic sessions, regarding the results of the 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 0.5 ECTS/day for national congresses, 1 ECTS/day for international congresses, 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, which corresponds to the recognition of 1 ECTS/day).

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 from the 1st year;
- 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. No ECTS credits are assigned to such activities.

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)
The doctoral students are strongly encouraged to draft publications on the research results, particularly in scientific journals indexed in Scopus and/or Web of Science (WOS), as well as in conference proceedings indexed in Scopus and/or WOS.). 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.
In cases where the conducted research exhibits a high degree of innovation, the PhD student is further encouraged to initiate the patenting process in accordance with the university offices.
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).