# DOCTORAL PROGRAMME

IN

INDUSTRIAL ENGINEERING

*Director prof. Giovanni Ferrara*

XXXVII cycle – academic year 2021/2022

## TECHNOLOGICAL AREA

<table>
<thead>
<tr>
<th>ADMINISTRATIVE OFFICE</th>
<th>Department of Industrial Engineering Florence (DIEF)</th>
</tr>
</thead>
</table>

## CURRICULA

| 1. | Energy and Innovative Industrial and Environmental Technologies |
| 2. | Design and Development of Industrial Products and Processes |
| 3. | Industrial Engineering and Reliability |
| 4. | Science and Engineering of Materials |

## POSITIONS AVAILABLE: 17

- Positions with scholarship: 15
- Positions without Scholarship: 2

## SCHOLARSHIPS: 15

| 6 - University of Florence |
| 5 - Department of Industrial Engineering Florence (DIEF) |
| 1 - co-funded by Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali (INSTM) and Department of Industrial Engineering |
| **Thematic:** “Nano-structured magnetic materials: development and applications” |

| 1 - co-funded by Consorzio PIN and Department of Industrial Engineering |
| **Thematic:** “Value-based healthcare and technology assessment: applications in home care services” |

| 1 - Nuovo Pignone tecnologie s.r.l. |
| **Thematic:** “Numerical modelling and test support of non-conventional gas turbine combustion processes involving Exhaust Gas Recirculation, fuel mixtures based on ammonia, hydrogen and/or high C2+ hydrocarbon content” |

| 1 - KW Apparecchi Scientifici |
| **Thematic:** “Development of systems & components for ultra-low-temp solutions” |

## STUDY/RESEARCH PERIODS ABROAD

Mandatory only for positions with scholarship

## MANDATORY PERIOD REQUIRED

3 months
DOCUMENTS REQUIRED FOR THE ADMISSION (under penalty of exclusion)

- Copy of the Identification Document
- Self-declaration for qualifications (bachelor’s/Master’s/combined cycle degree) obtained in Italy with a list of all exams taken and their mark, title of the thesis and graduation mark (download the form here make sure you fill in in all the fields)
- Foreign qualification required to access with a list of all exams taken and their mark, title of the thesis and graduation mark

The same documentation except for the final mark must be submitted by those who will graduate by 31/10/2021

DOCUMENTS REQUIRED FOR THE EVALUATION

MANDATORY
- Curriculum Vitae
- Research project

OPTIONAL
- Abstract of the MSc degree Thesis
- Scientific publications
- Any other additional qualification document

REFERENCE LETTERS

A section is provided in the online application to specify the e-mail addresses of two professors/researchers willing to provide information about candidates training path and activities performed within a scientific field related to the Ph.D. course.

RESEARCH PROJECT

The research project must be written in Italian or English in NO MORE than 12,000 characters including spacing, abstract, introduction and references. The project must be related, and should make specific reference, to one of the proposed work subjects listed in the below section “Thematics”.

EVALUATION PROCEDURE

- Evaluation of curriculum vitae, research project, publications and/or other qualification documents
- Interview

As detailed in the section below “Evaluation Marks”.

OTHER LANGUAGES FOR THE INTERVIEW

English

INTERVIEW MODE

Remotely (videocall)

EVALUATION MARKS

<table>
<thead>
<tr>
<th>parameter</th>
<th>minimum score</th>
<th>maximum score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum vitae; publications, other qualification documents</td>
<td>12/120</td>
<td>18/120</td>
</tr>
<tr>
<td>Evaluation of the research project</td>
<td>48/120</td>
<td>62/120</td>
</tr>
</tbody>
</table>

Applicants who obtain a mark of at least 60/120 according to the minimum score for each parameter will be admitted to the interview.

Interview: discussion of the research project and publications (if any) | 20/120 | 40/120 |

Eligibility is achieved with a minimum score of 80/120
- Advanced numerical modelling of combustion and heat transfer processes in gas turbine combustors using unconventional fuels based on hydrogen blends or liquid synthetic fuels
- Development and innovation in gas turbine cooling systems through new manufacturing technologies
- Numerical modelling and test support of non-conventional gas turbine combustion processes involving Exhaust Gas Recirculation, fuel mixtures based on ammonia, hydrogen and/or high C2+ hydrocarbon content
- Resilient Energetic Smart city analysis with economic analysis
- Aerodynamics and aeromechanics design methodologies for multi-stage axial compressors
- Numerical methods for the multi-disciplinary design of turbomachinery modules for industrial applications
- Geothermal Energy for Emerging Countries
- Research and development of innovative methodologies based on reverse engineering and additive manufacturing for biomedical devices
- Development of tools and methods based on reverse engineering for the diagnosis and treatment of scars in paediatrics
- Development of numerical and experimental approaches for the characterisation of operating machines
- Development of Actuator Line simulation methods for horizontal axis wind turbines
- Value-based healthcare and technology assessment: applications in home care services
- Development of digital twins for logistics service optimization
- Nanostructured magnetic materials or molecular magnetic materials and their applications respectively in the sectors: a) of induction catalysis, replacement of critical materials, and high frequency electronic devices; b) of molecular electronics, spintronics and optoelectronics for the development of technologies for quantum computation and data storage.
- Development of intelligent strategies for biosignals monitoring and processing in biorobotics applications
- Development of control strategies for autonomous underwater vehicle-manipulator systems
- Development of navigation strategies for autonomous underwater vehicles for monitoring and for intervention
- Optimisation of driving dynamics and wheel-rail interaction railway vehicles
- Multi-physics structural optimisation of railway vehicle components
- Development of fluid-dynamic and direct-contact bearing for rotordynamic applications
- Theoretical, numerical and experimental research on refrigeration with natural fluids
- Biomimetic humid air processes for water treatment and high-efficiency HVAC
- Hydrodynamic cavitation applied to the extraction of nutraceutical substances from biomass
- Study and development of motor cognitive dual task protocols for early diagnosis in neurodegenerative diseases through wearable sensors, neuroimaging and machine learning
- Study and development of bio-inspired social robots for rehabilitation and clinical assessment in neuro-cognitive declines
- Numerical / experimental techniques for the development and approval of advanced driver assistance systems (ADAS) in a controlled environment and
on the road.
- Development of smart systems for the use of solar energy and PED solutions
- Development of systems & components for the rationalization of energy use at industrial and residential level
- Development of systems & components for ultra-low-temperature solutions
- Study and development of a single-user electric vehicle

Further information available at the following web page: https://www.dief.unifi.it/vp-344-dottorato.html

### EXAMINATIONS SCHEDULE

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
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<tbody>
<tr>
<td>INTERVIEW</td>
<td>September 7th 2021</td>
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</table>

The list of the candidates admitted to the interview and the final ranking will be published at the following web page: https://www.unifi.it/p12018.html