PhD programme in "Industrial Engineering" Cycle XXXVI

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"Tor Vergata" University of Rome

Department of Industrial Engineering

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General presentation

Postgraduate training plays a fundamental role in the employment prospects of any young graduate student. The technological and innovative goals of modern industry are more and more complex and require a multidisciplinary and multisectoral approach. It is therefore of the utmost importance to integrate multiple specific skills in areas ranging from engineering to physics, involving chemistry, biology and medicine. This entails a necessary remodeling of the training courses, providing specialist knowledge, scientific methodology, flexible mentality and ability to work in organized research teams in order to solve complex problems and make the most of the potential of Industry 4.0.

The PhD in Industrial Engineering of the Rome "Tor Vergata" University has made multidisciplinary approach and close relationships with national and international companies its distinctive character. The research topics present in the PhD program cover a wide range of applications such as: industrial design, new materials and technologies, energy and the environment, engineering applications for medicine and sports, sensors, robotics, diagnostics for cultural heritage and management. This choice has proved successful and the doctorate has grown remarkably in the past years, bringing together colleagues from other universities and thematic areas. An extensive network of international relationships was developed and quite a few agreements were achieved with companies with research and development departments operating in different industrial sectors.

This approach is assessed by the fact that members of the teaching panel belong to research institutes and universities from 12 countries of the European community. In addition, many national and international companies actively collaborate to the PhD programme, 12 of which have signed specific permanent agreements. The Doctorate is also associated with 6 international universities from France, Germany, Switzerland, Albania, India and Mexico.

As a result, an average of about 80 PhD students have been attending the programme each year in the last 5 years, approximately 30% of them coming from foreign countries.

Main Objectives and Professional Opportunities

Basically the main goal of the PhD programme is to train students to become "problem solvers". In order to do so, academic and specialist courses are given, as well as seminars, schools and guided research activities. The duration of this whole set of training activities is 3 years. It is intended to provide the students with quite a few skills in their specific area of interest, such as: theoretical knowledge, experimental abilities, technological expertise, methods for calculus, modelling and simulation.

The outcome of the process, is hopefully to form proactive professionals able to "tune" their skills with the increasingly complex demands from the market, in search of constant and challenging technological innovations.

As a matter of fact, beside the connection with Italian and international Universities and research Institutes, the PhD programme in Industrial Engineering is strongly related to and supported by public and private companies as well. They greatly appreciate the ability to deal with design, production and characterization in the field of technological applications. This is why quite often our PhD students find out career opportunities soon after their PhD final exam and the achievement of their Doctoral Degree. Indeed, most of our former PhD students are now employed in R&D branches of important companies, while others work in research institutes and universities.

The Program

Research

At the beginning of the Doctoral Program each student is assigned a tutor who supervises the course of his/her studies. The tutor is appointed by the PhD panel. During the whole period of the PhD program, the tutor supervises and supports the preparation and training of the student, and takes care to verify the good quality of his/her research activities. The tutor will manage to schedule periodical meetings with the student, in order to assess the progress in the research program.

In general, the first year of the programme is mainly devoted to a review of the available literature related to the research project the PhD students proposed in their enrolment procedure, preliminary research on its experimental feasibility, together with the acquisition of basic technical and scientific knowledge on standard methodologies.

In the second year, specific experiments have to be designed and realized by the students under the supervision of their tutor, so to end up with a set of comprehensive and self-consistent experimental datasets.

The third year is mainly devoted to the analysis, elaboration and discussion of the gathered experimental results, as well as to the writing of the final thesis.

At the end of each year, a general assembly of the PhD program is organized. All of the students are asked to give the PhD panel an oral presentation, summarizing their latest experimental activities and results. An overall evaluation is performed by the tutors and the members of the PhD panel. Upon approval of the presented work, the students are allowed to enter the following year of their PhD program. For students in their 3rd year, such an approval implies the admission to the PhD final exam.

Training

The PhD education program prescribes the acquisition of 12 credit points per year during the first two years. This is achieved by joining courses to be chosen in agreement with the assigned tutor, so to personalize the training program according both to the student expectations and the need of acquiring a specific background. The choice will be among the following modules (in Italian or in English):

1. **Preparatory courses**, which are mandatory for the students during their first year. Basically 5 of such courses are offered:
    o "How to design and report your experiments";
    o "Collection, analysis, discussion and publication of experimental data in a scientific report/paper";
    o "Protecting technological and business innovations. An introduction to intellectual property and patenting";
    o "Writing and proposing a research project"
    o "English course"
2. **Academic general courses**, normally delivered by our or other Italian and foreign Universities.
3. **"On demand" specialist PhD courses**, to be chosen among the following courses given by members of the PhD panel and experts cooperating in the doctoral activities:
    o Corrosion of Metallic Materials
    o Optical and X Ray-based diagnostics for non-stationary liquid jets characterization
    o Fundamentals of plastic flow: analysis and modelling
    o Technologies and Methods of Sport Performance Assessment

- o Therapeutic Ultrasound technologies: engineering topics and solutions for pre-clinical (cellular and in-vivo) and clinical applications.
- o Technology and metallurgy of welding
- o Surface Characterization and Analysis
- o Automatic measurement systems for electromechanical and biomechanical applications
- o Conductive Heat Transfer
- o Functional and smart materials: classification, features and applications
- o Advanced optics for sensors and integrated devices
- o High temperature behaviour of metallic materials and their energy and industrial applications
- o Laser power Technologies and application
- o Introduction to data analysis: mathematical background and computational tools
- o Measurements for Identification and Control of Tokamak Plasmas
- o Technologies applied to health
- o Advanced optics for sensors and integrated devices
- o Failure analysis course
- o Synthesis, characterization and biomedical applications of nanostructured carbon and metal oxide-based materials
- o Multispectral imaging applied to the cultural heritage study
- o Signal analysis and modelling of biological systems
- o Mechanical Spectroscopy: principles and applications
- o Optothermal investigations for the analysis of Cultural Heritage structures
- o Photothermal techniques and their applications
- o Machine Learning Techniques for the design and the operational safety of TOKAMAKS.
- o Flow and Heat Transfer Measurements
- o Laser Spectroscopy
- o Hadrontherapy: introduction to physics, biology, dosimetry and Monte Carlo simulations.
- o Optical characterization of semiconductors
- o Nanomaterials
- o Mechanical and Thermal Measurements: experiments and statistical analysis of data
- o Industrial property law
- o Additive manufacturing of metals: microstructural features
- o Innovative heat treatment of steel and non-ferrous alloys
- o Metallic material for automotive and energetic application
- o Porous materials: classification, features and applications
- o Light Alloys metallurgy and related technologies with industrial applications
- o The 'Paradox' of the galilean scientific method. Methodologies of Modern Physics
- o X-ray diffraction techniques for materials characterization
- o Ionizing radiation dosimetry in medical applications.
- o Thin films deposition and micro-fabrication techniques for solid-state devices.

4. **Summer Schools**, **Workshops**, **Company Training Courses**

Personalized training plans will be devised for PhD students by their tutors, in order to provide them with the best and most appropriate learning and training opportunities. Training also includes lectures, seminars, schools and guided research activity. PhD students are also strongly encouraged to attend courses aimed at improving the level of their knowledge of the English language.

Even though a certified knowledge of the English language is not a stringent requirement for admission, students are advised that the entrance exam includes an assessment of the knowledge of the English language, several of the above mentioned training courses will be given in English and the PhD thesis has to be written in English.

Multidisciplinary, International and Intersectoral approach

Meeting the needs of a changing labour market requires greater emphasis on the EU Triple-I recommendations on doctoral training: to be international, interdisciplinary and intersectoral. In order to fulfil such requirements, several research fields are covered by expertise of the members of both scientific and advisory panels of the PhD program. They belong to quite a few different Scientific and Disciplinary Sectors (see the SSD list below), ranging from engineering to physics, involving chemistry, biology, medicine, management and law.

In addition, carrying out study and research activities at external laboratories is strongly recommended in the PhD training program. Joint PhD paths with International Institutions, as well as Joint and Double PhD, Exchange and Erasmus+ programmes are supported by the "Tor Vergata" University PhD School. More specifically, well assessed cooperation and/or formal agreements are active between the PhD Programme in "Industrial Engineering" and the following Universities, Research Institutions and private companies (also listed below in alphabetic order):

Partner Universities and Research Institutions

CNRS – Université de Poitiers (France)
ENEA-BOLOGNA (Italy)
ENEA-CASACCIA (Italy)
ENEA-FRASCATI (Italy)
INFN (Italy)
Institut National des Sciences Appliquées (France)
Universidad de Málaga (Spain)
Max Plank Institute (Germany)
National Institute of Materials Science (Japan)
National Research Council (Italy)
National Research Council (Russian Federation)
Politehnica University Timişoara (Romania)

S. Mary's University (Canada)
Technische Hochschule Wildau (Germany)
Tokyo Institute of Technology (Japan)
Universidade Fernando Pessoa (Portugal)
Universita' Aix Marseille (France)
Universitatea "Dunărea de Jos" din Galaţi (Romania)
Université de Montpellier (France)
University Of Applied Sciences Hes-So (Switzerland)
University of Applied Sciences of Yeverdon (Switzerland)
University Of Twente (Netherlands)
Wroclaw University of Science and Technology (Poland)

Private Companies Supporting the Programme

CAPTIKS Srl
Probablin & Tefarm Srl
Polo Rosso Srl
Ansaldo Nucleare SpA
SER TEC Srl
FIS & DM Srl
CALEF Consortium
Vitrociset SpA

Promedica Bioelectronics Srl
ENPROJECT MEDICALI Srl
DIESSE DIAGNOSTICS SENESE SpA
TECNOGYM SpA
Walter Tosto SpA
OCEM Srl
SENSORMEDICA

Application and Enrolment

Requirements

The call is open to Italian and International citizens. They are requested to have achieved a second level degree obtained in Italy by October 31st 2020, or a similar academic title obtained abroad, equivalent for duration and content to the Italian title.

The admission to the programmes will be established according to: (i) the evaluation of the candidates' curricula, (ii) the proposal of a possible PhD research project, which the candidates can submit contextually with their application to the admission announcement and (iii) an interview with a committee of selected members of the PhD scientific panel.

Call for application

The call for application to the 36th cycle of the PhD programmes of Rome "Tor Vergata" University is available at the following websites:

http://dottorati.uniroma2.it/index.php/it/ (Italian candidates)

http://dottorati.uniroma2.it/index.php/it/english (foreign candidates)

Contact persons for additional information

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