



UNIVERSITÀ  
DEGLI STUDI DI TRIESTE

Rettorato e Direzione Generale  
Sezione Ricerca e Dottorati  
Ripartizione Dottorati

LAST REVISED 15/10/2012

**DOCTORAL SCHOOL IN  
ENVIRONMENTAL AND INDUSTRIAL FLUID MECHANICS**

**NOTE:** This attachment provides only partial information. Exhaustive information, including how to register for the selection, is published in the Admission Announcement posted in the web page <http://www2.units.it/dottorati/> >> Admission Announcement.

|                                 |   |
|---------------------------------|---|
| Deadline for online application | <b>31 August 2012 at 11.30 a.m. CET</b> |
|---------------------------------|---|

**GENERAL DESCRIPTION**

SUBJECT AREAS:

- main area: ICAR/01
- other areas: INF/01, MAT/05, MAT/07, MAT/08; ING-IND/06; ICAR/01; GEO/02; GEO/11; GEO/12

RESEARCH FIELDS:

1. Fluid mechanics in industrial processes and technological systems
2. Fluid mechanics in biological systems
3. Environmental large scale flows
4. Mathematical methods and modeling in fluid mechanics
5. Qualitative theory of nonlinear differential equations
6. Three-dimensional turbulence

LOCATION: Trieste

ORGANIZING DEPARTMENT: Dip. di Matematica e Geoscienze

OTHER PARTICIPATING INSTITUTIONS (Italian):

- OSMER ARPA-FVG
- ENEA
- Istituto Nazionale di Oceanografia e Geofisica Sperimentale (INOGS)
- Istituto Scienze Marine (ISMAR-CNR)
- International Center for Theoretical Physics (ICTP)

DURATION: 3 years

MAXIMUM NUMBER OF MONTHS TO BE SPENT ABROAD: 12

OFFICIAL LANGUAGE OF THE SCHOOL: English

**ADMISSION INFORMATION AND REQUIREMENTS**

NUMBER OF PLACES AVAILABLE: .....8

**Please note that the number of seats available has increased from 6 to 8, the amendment added 15/10/2012**

- SCHOLARSHIPS: ..... 6

FUNDING BODY/IES (preceded by the scholarship code):

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- [code M/1-3] Università degli Studi di Trieste .....3
- [cod D/4] Dip. di Matematica e Geoscienze funded by International Centre for Theoretical Physics “Abdus Salam” (ICTP) (Project title: “*Experimental studies of black hole horizon effects in analogy gravity systems*” .....1
- [cod D/5] Dip. di Matematica e Geoscienze funded by International Centre for Theoretical Physics “Abdus Salam” (ICTP) (Project title: “*Surface hydrology over Africa and its impact on climate*”) .....1
- [cod D/6] Dip. di Matematica e Geoscienze funded by Istituto Nazionale di Oceanografia e Geofisica Sperimentale (OGS) (Project title: “*Modelization of physical oceanography phenomena*”) .....1

Candidates who accept an earmarked scholarship are committed to the pre-assigned topic

**Candidates have to list (in order of preference) the scholarships they apply for by specifying the corresponding codes in the “[QUALIFICATIONS LIST](#)”. If extra earmarked scholarships become available after candidates have completed their application, they can modify their list within the deadline for receiving certificates.**

ACADEMIC QUALIFICATION REQUIRED: see Announcement (art. 1.1 - Requirements)

DEADLINE FOR COMPLETION OF DEGREE: ..... **10.10.2012**

ASSESSMENT CRITERIA: Qualifications

- MAXIMUM FINAL SCORE: .....100/100

MINIMUM FINAL SCORE REQUIRED: .....60/100

QUALIFICATIONS REQUIRED/RELATIVE WEIGHT:

- Art. 11 Announcement: all candidates are required to present the following documents, regardless of whether or not a score is assigned to them (see below):

a. a detailed curriculum vitae et studiorum: 10/100

b. a copy of the Master’s degree thesis: 40/100

For students with a degree awarded by a non-Italian University, an abstract of the thesis in English or Italian is sufficient.

as well as:

1. academic qualification with the transcript of the exams and scores: 20/100

2. letters of recommendation: 10/100

3. the motivations for enrolling to the programme: 10/100

6. Certificate GRE: 5/100

7. Others: 5/100

- Qualifications List (unless this form is presented, qualifications and publications CANNOT be assessed by the Examining Board)

MINIMUM SCORE REQUIRED FOR QUALIFICATIONS/PUBLICATIONS: .....60/100

ABSOLUTE DEADLINE FOR RECEIVING CERTIFICATES: ..... **15.10.2012**

**if by email within midnight CET**

ADDRESS TO WHICH CERTIFICATES SHOULD BE SENT:

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- by email to [eifm.adm@units.it](mailto:eifm.adm@units.it) (please zip all the documents attached, including the Qualifications List form)
- alternatively on a CD/DVD, by mail to Segreteria del Dipartimento di Matematica e Geoscienze, Via Valerio 12/1 – 34127 Trieste, Italy

CEFR LEVEL: B2

## CONTACT INFORMATION

**DIRECTOR OF THE SCHOOL:** Prof. Vincenzo Armenio - Dipartimento di Ingegneria civile e architettura - Università degli Studi di Trieste - tel. 040/5583472 fax 040/572082 e-mail [armenio@dica.units.it](mailto:armenio@dica.units.it)

**VICE-DIRECTOR:** Prof. Pierpaolo Omari – Dipartimento di Matematica e Informatica – Università degli Studi di Trieste – tel. 040/5582619 - e-mail [omari@univ.trieste.it](mailto:omari@univ.trieste.it)

**WEB SITE:** <http://phdfuidmechanics.appspot.com/>

**SCIENTIFIC PROJECT:** Fluid mechanics studies the properties and behaviour of fluids, that is, liquids, gases, plasmas, and more generally of substances whose molecules have no fixed positions in space but can move relative to each other with different relative speeds. It involves physical phenomena of relevant complexity and has a broad range of applications. Most environmental systems involve the dynamics of water and gases that is described in terms of fluid mechanics, such as, e.g., diffusion of pollutants, or issues of marine and atmospheric meteorology. Similarly, biological systems are regulated by transport and dispersion of elements or species in water, air, and blood. Many industrial problems are concerned with fluid processes: for instance in transportation (automotive, aeronautic) applications, or in processes where chemical-fluid dynamic interaction is expected.

The fundamental laws upon which this discipline is based are generally expressed by partial differential equations, often nonlinear and highly complex: their study requires the application of various methods of advanced mathematics and is a research field of high theoretical and practical relevance. In addition, the numerical resolution of these equations usually requires the development of sophisticated computational techniques.

The Doctorate School in Environmental and Industrial Fluid Mechanics aims to prepare students in the fields described above, in particular in the study of processes involving fluid flows and their transport, dispersion and mixing properties in the environmental or industrial processes, as well as of their interaction with the solid elements. Thermodynamics and microphysics of the large-scale processes and interactions between fluids and solid elements are also considered. The study of mathematical models, both from the theoretical and the computational point of view, is a relevant part of the program as well..

**EDUCATIONAL AIMS AND RESEARCH TOPICS:** The main objective is to provide students an adequate knowledge in fluid dynamics, mathematical methods, large-scale physics flows and industrial applications. The program aims to prepare students

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to pursue different careers in research, teaching and in the industrial use of high technologies in the above mentioned areas. The final dissertation must be original, must represent the state of the art in the chosen field and should contain material for the publication of scientific papers in international journals of the field included in the ISI or SCOPUS catalog. The students will be in contact with several local and international environments and gain a considerable experience in both theoretical and applied problems of fluid mechanics. In addition, the students will develop familiarity and competence in the use of more advanced tools (both modeling and experimental) for the analysis of complex physical systems, which will be of great use for future activities in public or private research centers or for any work in companies with high technological content.

All students must follow a program of courses in order to achieve good skills in mathematical methods, fluid dynamics, computer science, oceanography, and dynamics of the lower atmosphere. In particular "core courses" and "research-based courses" are offered. The core courses must provide the tools for understanding the physical phenomena involved and will focus on topics of mathematics (partial differential equations, numerical analysis, statistics), computer science, basic and advanced fluid dynamics, computational fluid dynamics, experimental techniques in fluid dynamics. The research-oriented courses will include research-based geophysical fluid dynamics, physics and modeling of turbulence, physical oceanography, dynamics of the lower atmosphere, advanced mathematical methods for the study of qualitative properties of some classes of nonlinear differential equations of interest in fluid mechanics, numerical methods for the development of computational techniques. There will also be periodic seminars delivered by experts, to which students are expected to attend.

We further note that:

1. there are no similar programs of Industrial and Environmental Fluid Mechanics in the region Friuli Venezia Giulia;
2. the program has a partnership with foreign programs;
3. the school program creates a strong link between national and international research bodies and institutions operating in the city of Trieste, in the region Friuli Venezia Giulia and in the Alpe-Adria region (ICTP, OGS, CNR-ISMAR, OSMER-FVG, ENEA);
4. the college faculty is composed of mathematicians, physicists and engineers working in complete synergy in the understanding of physical problems and in the knowledge of mathematical and computational models.

## RESEARCH FIELDS

The following research fields are considered:

1. Planetary and environmental large scale flows;
2. Three-dimensional turbulence;
3. Fluid mechanics in biological systems;
4. Fluid mechanics in industrial processes and technological systems;

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5. development of advanced mathematical methods for the qualitative study and the numerical solution of partial differential equations occurring in fluid mechanics.

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