



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

The Doctorate in Environmental and industrial fluid mechanics becomes operative as a “Doctoral School” or as “Doctoral Course” according to how many scholarships become available.

GENERAL DESCRIPTION

SUBJECT AREAS:

- main area: ICAR/01
- other areas: INF/01, MAT/07, MAT/05, MAT/08; ING-IND/06; ICAR/01; 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. Existence, uniqueness, regularity and stability of solutions of nonlinear differential equations in fluid-mechanics
6. Three-dimensional turbulence

ORGANIZING DEPARTMENT: Dip. di Matematica e Informatica

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:7

- SCHOLARSHIPS: 7

FUNDING BODY/IES:

- [cod M/1-3] Università degli Studi di Trieste 3
- [cod MD/4] Università degli Studi di Trieste + Dip. di Matematica e informatica funded by dell'Enea UTMEA – Energy and Environmental Modeling (Project title: “*Analysis of fluid-mechanics efficiency of wind turbines*”) 1
- [cod D/5] Dip. di Matematica e informatica funded by dell'International Centre for Theoretical Physics “Abdus Salam” (ICTP) (Project title: “*Experimental and numerical high Rayleigh number convection*”) 1
- [cod D/6] Dip. di Matematica e informatica funded by dell'Istituto Nazionale di Oceanografia e Geofisica Sperimentale (OGS) e ESP-ICTP (Project title: “*Climate modelling of atmospheric-ocean coupled system of mediterranean areas and their impacts on bio-chemical cycles*”) 1
- [cod D/7] Dip. di Matematica e informatica funded by ARPA-FVG (Project title: “*Mathematical modelization of sedimental trasport in Tagliamento and Isonzo rivers and analysis of erosion/da position in coastal areas*”) 1

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

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



UNIVERSITÀ DEGLI STUDI DI TRIESTE

Sezione Ricerca e Dottorati

Ripartizione Dottorati

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

DEADLINE FOR COMPLETION OF DEGREE: **20.11.2011**

ASSESSMENT CRITERIA: Qualifications

- FINAL SCORE: 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 Evaluation Form (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:..... **02.12.2011 if by email within by midnight CET**

ADDRESS TO WHICH CERTIFICATES SHOULD BE SENT: in person or by mail to Segreteria del Dipartimento di Matematica e Informatica, Via Valerio 12/1 – 34127 Trieste or else by email to eifm.adm@units.it (please zip all the documents attached)

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

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

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

SCIENTIFIC PROJECT: The mechanics of fluid flows is an important part of mechanics, it involves rather advanced physical phenomena, 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. 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, in processes where chemical-fluid dynamic Interaction is expected, and so on. The program of the school is specifically interested in the processes involving motion of a fluid, and the related properties of advection, dispersion and mixing within the fluid itself. In evoking fluid mechanics, one has to think in a very broad sense, including large-scale and small-scale processes, transport phenomena at the relevant scales, interaction between a dissolved phase and the carrying fluid, and the possible effect of mixing and biological aspects. Moreover, the extension of fluid dynamics to applicative purposes often involves interaction with nearby mathematical and physical fields. Thermodynamics and microphysics of the large-scale processes, as well as interaction between fluids and solid elements, are therefore part of the program.

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

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art in the chosen field and contain material for the publication of scientific papers in international journals of the field included in the ISI 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 dynamics. 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 research centers or for any public or private work in companies with high technological content.

All students must follow a program of courses in order to achieve adequate 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 advanced 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. There will also be periodic seminars taught 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;
5. Mathematical methods and modeling in fluid mechanics.

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