

# EURHEO: the Erasmus Mundus Master in Engineering Rheology

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## Introduction

EURHEO ([www.eurheo.eu](http://www.eurheo.eu)) is a two-year Master course delivered under the prestigious Erasmus Mundus programme. EURHEO aims at offering a pioneer advanced education programme on Rheology and its applications to different Engineering areas. It combines the expertise of six leading European Universities in the field of Rheology (University of Minho (UM - Portugal), the University of Ljubljana (ULJ - Slovenia), the Universidad de Huelva (UHU - Spain), the Katholieke Universiteit Leuven (KUL - Belgium), the Université catholique de Louvain (UCL - Belgium) and the University of Calabria (UCAL - Italy)) and the syllabus is designed to provide students with the necessary competences to understand the relevance of Rheology in Materials Science and Engineering and apply the knowledge gained in solving real-world Engineering problems both autonomously and included in multidisciplinary research teams.

We will present the EURHEO education programme, and the types of grants that Portuguese and Spanish students can apply for.

The first scientific EURHEO outputs, namely results from selected Master theses, will be presented in 2 posters which report the research carried out by 2 students at UM.

## Programme structure and information

EURHEO is a Masters programme with a total duration of 2 academic years and 120 ECTS credits and the general structure depicted in Figure 1. The study programme starts with the first 60 ECTS credits, i.e., the first academic year, being taken by the students at one of five Higher Education Institutions, HEI, as part of their Primary Studies Programme, PSP. The second academic year will consist in a fully Integrated Studies Programme, ISP, which starts with the students taking 15 ECTS credits corresponding

from the so-called Common Branch Modules (see below) at the University of Minho, followed by another 15 ECTS credits of Advanced Topical Modules, at a HEI in a country other than that where they studied in the first year (see below). The programme ends with a 30 ECTS R&TD project at the latter HEI.

### *First year*

In the PSP each HEI will offer first year syllabi with different focus that reflect the respective area(s) of expertise, whilst ensuring, nevertheless, that the students are given the necessary background and mathematical and physical tools to be able to take the second year fully integrated syllabus. The most important mechanism in this case will be to ensure that each HEI provides students with a minimum number of ECTS credits in areas identified by the consortium as core areas for the posterior specific work in Rheology. Thus, each HEI must offer, within the PSP, at least 20 ECTS credits of Materials Science and another 20 of Materials Engineering.

In addition to the standard portion of the PSP, it is foreseen that students with a good academic and professional record that originate from scientific areas to which Rheology is relevant but that typically have an education in Mathematics, Continuum Mechanics and Numerical Methods that is of lower standards than those expected of an education in Engineering, e.g., Biology, will have to take a Homogenisation Module, entitled "Continuum Mechanics and Numerical Methods". This course will be compulsory for those applicants that are selected by the Scientific Committee (see Admission Conditions) for admission into EURHEO but will not count towards the ECTS credit total; however, it will be duly recognised in the Diploma Supplement.

It is expected that by the end of the PSP the students will have a strong general education in

their scientific area of choice and are in a position to begin the specific studies on Rheology and its applications.

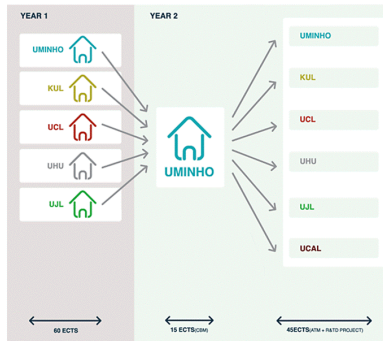


Figure 1. EURHEO Programme structure and mobility.

### Second year.

The ISP is the main component of the Masters, its main objective being to give students a strong education in Rheology and its applications to Engineering problems in the various areas. This will be the first time that a set of European HEIs will have a common syllabus in Advanced Rheology. The ISP will have four main components:

- The Common Branch Modules, CBMs,
- The Advanced Topical Modules, ATMs
- Complimentary Competences
- The R&TD Final project.

*I. CBM:* It is crucial that, regardless of their particular area of expertise, professionals of Rheology have some degree of knowledge of the possibilities, challenges and tools available to their fellow rheologists in complimentary areas. Thus, the aim of the CBMs is to introduce the students to the main areas of application of Rheology: Materials Science and Engineering, Instrumentation and Experimental Rheology and Theoretical and Computational Rheology, regardless of their background and set the stage for the advanced topics to be taught later. There will be four modules, of which the students will have to choose 3, totaling 15 ECTS credits; this assumes that the education imparted during the

PSP allows them to already have a high enough level of knowledge on one of the areas to allow them to be exempt from taking that Course. The four modules will be:

- Materials Science: 5 ECTS.
- Experimental Techniques: 5 ECTS.
- Constitutive Modelling and Computational Rheology: 5 ECTS.
- Rheology in Materials Engineering: 5 ECTS.

The CBMs will be lectured conventionally, i.e., in the format of conventional classroom lectures, at the University of Minho, in English, over a period of 8 weeks at the beginning of the second year.

*II. ATM:* Once the basic education in Rheology has been completed, students will then take the Advanced Topical Modules, ATMs, which, as the name implies, will be devoted to the in depth study of particular areas of Rheology that are of specific interest to each individual student. The students will have to choose three ATMs, totaling 15 ECTS credits, from a list of possible subjects. The full list of optional ATMs, which are taught in English, and respective ECTS credits is the following:

- Bio and Food Rheology: 5 ECTS.
- Solid-State Rheology: 5 ECTS.
- Complex Multiphase Systems: 5 ECTS.
- Hydraulics and Industrial Fluids: 5 ECTS.
- Complements of Materials Processing and Engineering: 5 ECTS.

The mobility scheme foresees the students moving from the first year host HEI to UMinho for the CBM and a third HEI for the ATM courses and the final R&TD project. Thus, the students will no longer be physically present at one location when they start the ATMs, implying that they will be taught at a distance, over the internet, using e-learning tools.

### *III. Complementary Competences:*

In order to complement the education of the students and ensure the high level of the Masters,

the following complimentary competences will be offered by the Consortium:

- A Workshop immediately before the beginning of Year 2. This will be aimed at bringing students together for the first time in one year and to introduce them to the possible R&TD areas and final projects.

*IV. Final R&TD Project:* The final Research & Technological Development Project, totaling 30 ECTS credits or one full semester of research, will be the culmination of the ISP. Through it the students will apply the good practices of scientific research, whether fundamental or applied, that they have learned during the curricular portion of the Masters and each individual project will be designed in such a way that it will force the students to integrate the entire body of knowledge they have acquired previously. An anticipated feature of the R&TD projects is that they will be developed as an integral part of the research activities of the various groups in the EURHEO Consortium and thus, each individual one will result in measurable outcomes, such as scientific papers, or in specific products for industry or academia, such as prototypes, new or improved materials and/or processes. Examples of 2 EURHEO theses defended in 2010 by students from the first edition are presented in the poster sessions of this conference. These are

- "Effect of Thermomechanical History on Final Properties of Carbon Nanotube-Polymer Composites" by Safa Jamali.

- "In-line Rheo-optical characterization of extruded complex fluids" by Sirikul Thepthong.

*V. Degrees:* The standard degree issued will be a double degree, which will be awarded by the two HEIs in which the student takes the PSP and the ISP. The titles of degree awarded for this Masters Course by this institution (in English) are:

**UMinho** - European Masters in Engineering Rheology

**KUL** - Master of Applied Sciences and Engineering: Chemical Engineering

**UHU** - European Masters in Engineering Rheology

**UCL** - Engineering Masters in Chemistry and Materials Science

**ULJ** - Masters in Mechanical Engineering

Each degree awarding institution will provide the student with a diploma supplement. All the diploma supplements will be issued in English and in the respective national language of the degree awarding institutions.

### Admission and scholarships

The Admission Requirements for students wishing to enroll in the EURHEO EM Course are:

- An undergraduate degree with a minimum of 180 ECTS credits or equivalent qualifications in relevant areas of Engineering, Exact Sciences or Natural Sciences;
- Sufficient level of proficiency in English. Students from non-speaking countries are required to have passed a TOEFL certificate with a minimum score of 525 (paper based) and 72 (internet based) or a IELTS certificate (with a minimum score of 6.5) or a similar certificate. A web interview can be conducted as a complementary means to prove language proficiency.
- Admission is made on a competitive basis; the students are assessed on the basis of their previous academic record. No difference in entry conditions is foreseen between Third Country and European students.

The admission criteria and relative weights will be the following:

- Criterion 1: Academic education – 50%
- Criterion 2: Language skills – 30%
- Criterion 3: Letter of motivation – 10%
- Criterion 4: Relevant professional experience – 10%

All applications will be judged by the Scientific Committee that will analyze the student's background and his/her choice of University and recommend the curricular structure. Thus, every student enrolled in EURHEO will have his/her own individually tailored Study Plan.

The application to the Erasmus Mundus Scholarships is considered part of the application to the Master Course. In due time, the candidates will be informed by the Consortium Secretariat about EM grants approval by the European Commission.

European students can apply for a Category B scholarship. The total scholarship amount is 20.000€. The Consortium deducts the correspondent tuition fees (4.000 EUR/year/student) from the total scholarship. Upon student arrival at the First Host Institution, s/he is requested to immediately open a bank account (your host institution will support the student with this procedure). The monthly allowance amounts may be increased in order to cover additional costs of students with special needs.

In addition to the Erasmus Mundus Scholarships, the EURHEO Consortium may offer **Consortium Scholarships**. They are financed by the EURHEO Consortium and are open to students of any nationality. Students selected in the calls and who do not obtain the EM Scholarships will be considered automatic candidates. The exact amount and number will be determined by the Scientific Committee.

The grant holders will be assisted by the University of First Enrolment in the procedure of opening a Bank Account, which is compulsory to the bank transfer of the scholarship.

In line with the spirit of Erasmus Mundus, EURHEO welcomes applications from outstanding Third-Country scholars to participate in the academic activities and in strengthening academic partnerships with the Consortium for periods up to 3 months. Third-Country scholars are expected to bring to the programme complementary competences to

those already existing in the consortium and strengthening academic partnerships with the Consortium. Scholars can apply directly to the Consortium Secretariat via e-mail, indicating their preference location and their field of expertise, and enclosing a copy of their Curriculum Vitae together with a letter of motivation describing the aims of the exchange during the planned stay, no later than April 30<sup>th</sup> of each year. The selection of scholars will be decided by the Scientific Committee, by ranking the candidates according to the academic and professional records, and the interest demonstrated in contributing to the EURHEO EM Course. A balance between experienced and young promising scholars will be sought, together with a fair distribution of scholars between the partners. The Consortium may also decide to make direct invitations to leading world experts. The Scientific Committee will prepare a selection list and a reserve list. This scholars' ranking list and reserve list are proposed and subject to the approval of the European Commission. Scholarships for teaching and research activities are sponsored by the European Commission under the scope of Erasmus Mundus Programme for a period minimum of two weeks and up to three months. As is the norm in Erasmus Mundus Masters, EURHEO will grant Incoming Mobility Scholarships to Scholars originating from third-countries, i.e., outside the European Union. Each scholar will receive a weekly grant of 1200€ and a fixed amount of 1000€ for travel expenses.

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