

## THE BOLOGNA PROCESS AND THE DOCTORAL STUDY AT THE FACULTY OF ENGINEERING

Since 2005/2006 the Faculty of Engineering of the University of Rijeka has been offering the new postgraduate doctoral study which on one hand is based on the tradition of postgraduate studies and scientific research work of the Faculty, and on the other hand it has been adapted to the new European knowledge area and to all demands imposed by the Bologna Declaration.

It should be pointed out that the transformation of the earlier existing doctoral study has been partially carried out also as one of the projects supported by the National Foundation for Science, Higher Education and Technological Development of the Republic of Croatia. This has contributed to the quality of the new curriculum since the program of the Foundation enabled the familiarization of the project team members, and through acquaintance with them also of all the teaching staff and Faculty members, with ideas and processes underway at European Universities, both through cooperation with a greater number of experts from institutions within and outside Croatia and through participation at a range of significant meetings: the First European Convention on Present and Future Challenges for Engineering Education and Research in Europe in Florence (November 2005), the 10th IACEE World Conference on Continuing Engineering Education (WCCEE) in Vienna (April 2006) and the SEFI Annual Conference 2006 "Engineering Education and Active Students" in Uppsala (June 2006).

The new doctoral study covers the area of Engineering Sciences, namely the scientific fields of Mechanical Engineering, Naval Architecture and Other Fundamental Engineering Sciences. It has been organized into seven modules: Production Mechanical Engineering; Thermal Energy Engineering; Computational Mechanics; Design and Building of Vessels; Mechanical Engineering Design; Quality Assurance and Engineering Systems Control; and Ecology Engineering and Environmental Protection.

The main differences between the present and former doctoral studies consist of the reduction of the teaching part of the study in the number of subjects and the duration of lessons (instead of all 6 semesters, 3 first semesters), in a significantly larger allotment and importance is attributed to the scientific research work as well as to clear evaluation/scoring of the students' activity in this work, to the introduction of a compulsory sojourn at one another scientific institution, and finally to the transparent definition of required student competence in every single subject as well as in the whole study.

The program of doctoral study has been organized for full-time and part-time students. It lasts from 3 to 4 years for full-time students and for part-time students 6 years. 20 students represent the optimal number of students per study year. By doing this evaluation, space, equipment, the number of teaching staff as well as the number of potential advisors of doctoral themes have been taken into account.

To this extent are not the biggest possible numbers which have been taken into consideration (1-2 students per possible advisor of a doctoral theme) but rather the significantly lesser number in order to provide the best possible conditions for every single student of the doctoral study. As regards the teaching field of the study, all the mentioned modules share four common subjects, of which one is compulsory – the Methodology of Scientific Research Work, while the other three mathematical subjects are elective in the sense that each module determines which of these subjects are compulsory or elective for that module and how many of these elective subjects the student has to choose. All other subjects are subjects of a particular module and the particular module offers maximally twenty subjects. Each module determines which subjects of the module are compulsory and which are elective and also how many subjects among the elective ones the student chooses. The student enrolls in a total of ten subjects of which, along with common subjects and subjects of the module he has chosen, he can also enroll in one free elective subject, i.e. any subject that is offered at the Faculty, i.e. University, and within the frame of postgraduate doctoral studies. Accordingly it can be said that of the 10 subjects the student has to enroll in, only 1 is compulsory, and since another 116 subjects divided into 7 modules are offered, the curriculum is highly individualized.

Quality assurance is also an essential new element. The Faculty, as branch of the University, through its quality team for the implementation of evaluation proceedings and inclusion in the university network system of quality assurance, works on: setting up the quality cycle, polling the students, development of quality indicators, research of study efficiency and causes of unsuccessful study, research of success in exams and organization of exams, research of efficiency of particular modules/subjects/chairs/departments, working out and implementation of testing of the final products' quality, implementation of internal evaluation and self-evaluation proceedings, preparation of external evaluation, discussions about the classes improvement and promotion of e-learning, examination of the competence of the teaching staff, organization of the education of personnel (teachers, collaborators, administrative staff), implementation of ISO standards into the administrative services. Of particular importance in making the decision for the quality of the doctoral study is the Committee for Postdoctoral Studies and Science of the Faculty as well as the Faculty Council. For example, these bodies participate in the approval of theses as well as the members of the committee for the approval of these theses and for defense of doctoral dissertations and similar, where the advisor is always chosen as an equal member (never as chairman) of such Committees. The official defense of the application of the doctoral dissertation is also obligatory, while the application is also widely accessible to the public, also including the web pages of the Faculty.

The conclusion can be drawn that the new doctoral study has many merits, some of which are a significant tradition in scientific research work, in the collaboration with international scientific institutions, as well as in the postgraduate studies of the Faculty on the one side and the complete structural and organizational adapting to the Bologna process realized through the project of the Foundation on the other. At the Faculty we have 23 current scientific research projects, several IT and technological-research projects, and 30 newly applied projects and 6 programs, as well as the long-standing practice of including junior researchers in scientific research work. Furthermore, in the proposed doctoral program, professors from several international universities are foreseen as subject teachers: The Faculty of Mechanical Engineering, University of Ljubljana, Slovenia; The Faculty of Mechanical Engineering, Gliwice, Poland; The Faculty of Mechanical Engineering, University of Maribor, Slovenia; The University of Udine, DIEGM, Italy; University of Tokyo, Japan; The Technical University Vienna, Austria; Paul Scherrer Institute (PSI), Villigen, Switzerland, etc. The students' mobility will facilitate the developed collaboration of the Faculty with a greater number of international universities: The Technical University Vienna, Austria; The Faculty of Engineering, University of Trieste, Italy; The University of Udine, Italy; The Faculty of Mechanical Engineering, University of Ljubljana, Slovenia; The Faculty of Mechanical Engineering, University of Maribor, Slovenia; The Technical University Brno, Czech Republic; The Technical University, Delft, The Netherlands; The University of Stuttgart, Germany; and the Faculty of Engineering, University Heriot-Watt, Edinburgh, Scotland; etc. An additional dimension to this study, in addition to collaboration with international scientific institutions, has come through the industrial and business sector that has been realised since the foundation of the Faculty: shipyards 3. maj and Uljanik, the factory and foundry CIMOS in Buzet i.e. Roč, INA (Petroleum Industry), HEP (Croatian Electric-Power Industry), Hrvatske vode (Croatian Waters), IGH (Croatian Institute for Building Trade). This cooperation is particularly evident through the doctoral study so that particularly complex problems from the industry result in scientific research and finally with the development of a doctoral dissertation. It is obvious that such form of cooperation is useful for the academic institution as well as for the industry that comes in this way to new and highly competitive products.

Naturally, the work on the transformation of the doctoral study has not finished yet. First of all it will be necessary to work intensively on the realization of this study program (curriculum) as it brings many novelties, especially the implementation of various instruments of quality control and similar aspects. New ideas for further transformation will surely arise through that work. For example, it is apparent at this very moment that a further remaking of the teaching part of the program in terms of reduction of number of subjects is necessary. In general the new criteria of scientific research work will surely influence the further increase in the quality of the study as well as of the

teacher's and advisor's work. Conversely, obligatory student sojourns at other institutions will additionally stimulate the already rich Faculty collaboration. All these processes will influence and form the future development of postgraduate studies at the Faculty. In particular, this doctoral study is the study of the Faculty of Engineering of the University of Rijeka, although a significant number of scientific teaching staff from other Faculties, member branches of the University of Rijeka, participate and additionally a greater number of scientists from other institutions in Croatia and abroad. In this matter particularly, some of the already existing modules of the doctoral study are interdisciplinary. Thus, farther development in this direction is expected, which will most likely lead to new modules in which other institutions inside and outside the University will participate. In this way also, progress in the development of doctoral studies as well as in the achievement of strategic goals of our society will be made.

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