

## **Double Degree Programme in Engineering Education: Practice and Prospects**

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## **INTRODUCTION**

The main reasons for developing and realisation of joint Master degree programmes in information technologies are participation of Russia in Bologna Process, high quality of Russian engineering higher professional education being recognised in Europe, interest of employers in hiring specialists with two or more diplomas of higher professional education, one of those is awarded by foreign university. These programmes allow combining experience gained in Russian and European higher educational systems, developing the cooperation between partners, raising the rating of the universities in Russia and abroad.

Nowadays development of joint Master degree international educational programmes in engineering and technology is important question for Russian technical universities. The global economic crisis has caused a significant increase in the tuition fees in leading European universities. In these circumstances, the flow of foreign students is likely to be increased in Russian universities, where the tuition fees are at the acceptable level and quality of education is high. We can see the growing interest of foreign students (especially from Asia and Africa) in studying Russian universities with following education in European partner universities.

## **1 DEVELOPMENT OF MASTER DEGREE PROGRAMME ALIGNED WITH EUROPEAN STANDARDS**

Starting from 2010 St. Petersburg State Polytechnical University had been taking part in Tempus project ECDEAST Engineering Curricula Design aligned with EQF and EUR-ACE Standards. The experience gained during work on this project helps to improve existing programmes and to develop new ones. One of the results of this project was developing and implementation of the Master degree programme "Intelligent Systems and Technologies". The programme meets the requirements of European standards. After successful completion of the programme graduates are awarded Master degree in Information Science and Computer Engineering.

The following step is developing of joint Master degree programmes in cooperation with European universities that meet requirements of Russian and European standards and allow graduates to receive two degrees – degree of Russian university and degree of European university.

## **2 DEVELOPMENT AND THE REALISATION OF MASTER DEGREE JOINT EDUCATIONAL PROGRAMMES BASED ON THE MODEL «TWO DEGREES IN TWO YEARS»**

### **2.1 Experience in double degree programmes implementation**

Starting from 2004, one of the priorities of the Control Systems and Technologies Department of St. Petersburg State Polytechnical University (CST Department) is the creation and implementation of joint international Master degree programmes based on the model of "two degrees in two years." It is impossible to create this kind of programmes without developing of modules in English language.

The base for double Master degree programme was one degree the programme "Intelligent systems" that was conducted in English language. CST Department has been realising the Master degree programme «Intelligent Systems» in the field of Information Science and Computer Engineering since 2003. The programme is mostly for foreign students. During the period this programme realisation students from China, India, Turkey, the USA, Egypt, Iran, Iraq, Netherlands, Finland and Ecuador successfully completed the programme.

Developing of double degree programmes was set up by the Russian-British project BRIDGE (British Degrees in Russia). City University London (UK) acted as foreign partner university and Russian partners were the St. Petersburg State Polytechnical University and the Penza State University. The result of this project was joint international Master degree programme that provides students with a unique opportunity to receive following degrees after two years of study:

- Master of Science in the field of Computer and Information Engineering of the City University London (UK);

- Master of Science in the field of Information Science and Computer Engineering of the St. Petersburg State Polytechnical University.

Joint educational programme was accredited by the Quality Assurance Agency of the UK and it is currently the only programme in the field of information technology implementing the model of "two degrees in two years" in our countries. The first group of Russian students were enrolled to the programme in 2007. 20 students had successfully completed the programme by this time.

During work on this project there were formulated requirements for academic mobility of students and teachers involved in the programme. It was shown that choice of schedule of the educational process is determined by the characteristics of the educational process in foreign partner-university in the first place. Results, obtained during working on the BRIDGE project were taken as a basis of double Master degree programmes implemented by St. Petersburg State Polytechnical University together with other European partners. In 2010 CST department started realisation of double degree programme together with the Lappeenranta University of Technology (LUT) (Finland) in the field of Technomathematics, and in 2011 - with the Leibniz University of Hannover (Germany) in the field of Mechatronics. [2]

The programme implemented in cooperation with the City University London (UK), originally was organised only for Russian students. Now there is discussion concerning the possibility of foreign students' enrolment in the programme.

The Master degree programmes in cooperation with the Leibniz University of Hannover (Germany) and Lappeenranta University of Technology (LUT) (Finland) focus on training students of Polytechnic University and a partner-university in the same group. According with the schedule of educational programme, students enrolled in the programme study during the 1st and 2nd semesters at St. Petersburg State Polytechnical University, and the next two semesters in European partner-universities. Continuation of the study for the second year in partner-university is possible only after successful completion of the first year in St. Petersburg State Polytechnical University. At the end of the second semester of the first year university provides to the partner academic record of students' results. All kinds of studies are conducted in English, and the curriculum and content of the courses allow them to be fully recognised by the partners.

Persons wishing to be enrolled in any of the above-mentioned joint Master degree programmes must have a higher professional education not less than the Bachelor level in information technology, computer engineering, applied mathematics and computer science. Knowledge of English language at a level B2 is mandatory for applicants. Admission to the programme is organised on competitive basis after passing the entrance examinations in the field of Information Science and Computer Engineering. The number of students that can be enrolled in each of the programmes is determined annually by the Russian and foreign partner universities.

## **2.2 Development of joint Master degree programme**

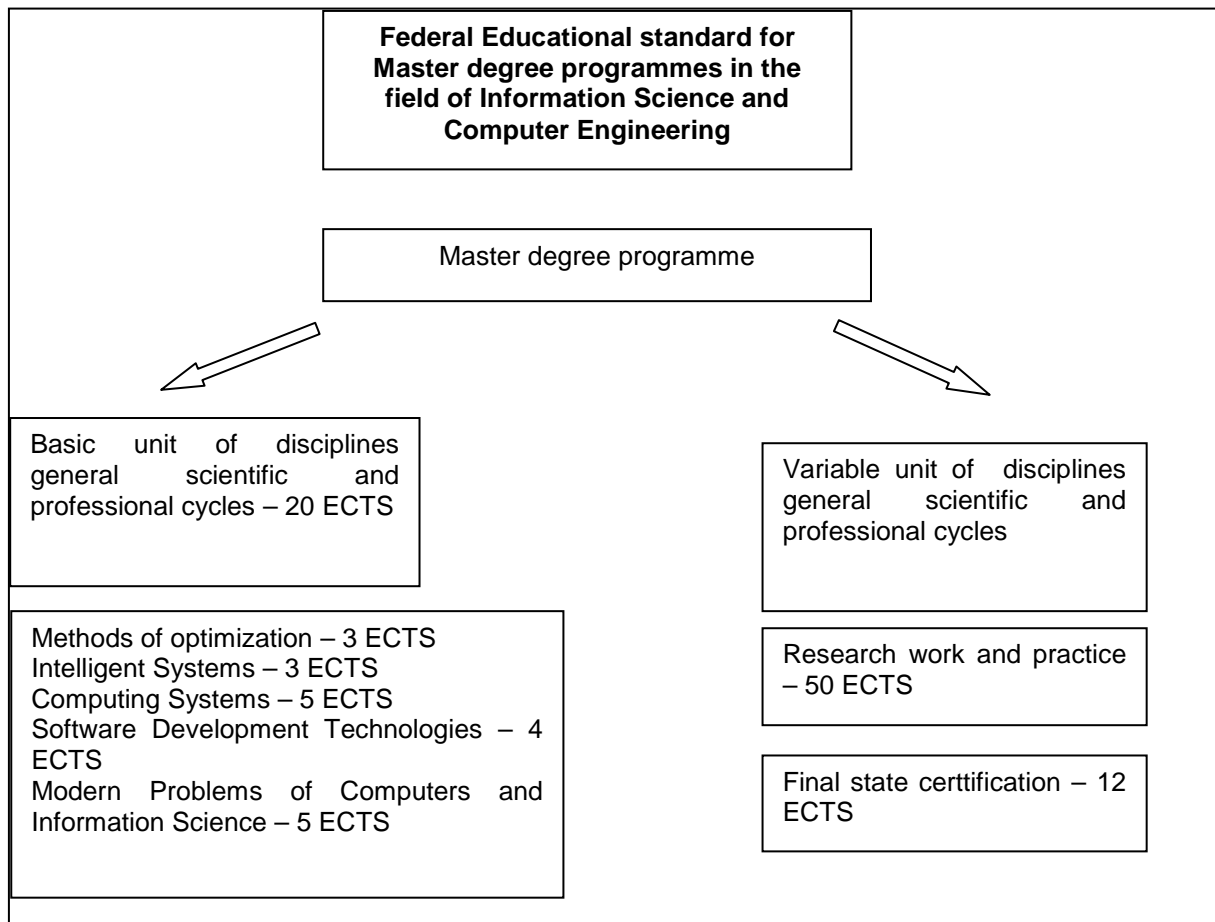
Before proceeding to develop the programme curriculum and schedule of the educational process, it is necessary to agree on ECTS value and content of the modules that students will study in each university. Therefore, the CST Department developed a special list of courses and draft of the curriculum of the double degree joint educational programmes [3] in accordance with the requirements of the Russian Federal state standard for Master degree programmes in the field of Information Science and Computer Engineering (Table 1).

Distribution of the disciplines between the partner universities is based on an analysis of the requirements for the content of curricula.

*Table 1 Master Degree programme in Information Science and Computer Engineering*

<b>№</b>	<b>Local code</b>	<b>Core modules</b>	<b>ECT S</b>	<b>Semester</b>	<b>Institute</b>
1	M.1.01	Intelligent systems	3	1	SPbSPU
2	M.1.02	Methods of optimization	3	1	SPbSPU
3	M2.01	Computing systems	5	2	SPbSPU
4	M2.02	Software development technology	4	1	SPbSPU
5	M2.03	Modern Problems of Computers and Information Science	5	1	SPbSPU
6	M.1.B.01	Knowledge Management and Knowledge Engineering	4	1	SPbSPU
7	M.1.B.02	Mathematical Modelling and Simulation	6	2	SPbSPU
8	M2.B.02	Neuroinformatics and Neurotechnologies	6	1	SPbSPU
9	M2.B.03	Intelligent Computing	6	2	SPbSPU
10	M2.B.03	Discipline of partner university	3	3	Partner university
11		<b>Elective modules</b>			
12	M2.BB.01 M2.BB.02	Cognitive and Multiagent Systems Intelligent Control Systems	8	2	SPbSPU SPbSPU
13	M2.BB.01 ..... M2.BB.0n	Discipline of partner university	3	13	Partner university
14	M2.BB.02 ..... M2.BB.0n	Discipline of partner university	4	3	Partner university
15	Facultative disciplines	Discipline of partner university	8-10	4	Partner university
16	M.3	Scientific and research work	50	1,2,3,4	SPSPU + Partner university
17	M.4	Master's theses preparation	12	3,4	SPSPU + Partner university
	SUM		130-132		

Fig. 1 shows units of disciplines and number of credit points for receiving a diploma at a Russian university in the field of Information Science and Computer Engineering.



*Fig. 1. Study cycles in educational programme in the field of Information Science and Computer Engineering*

Disciplines included in the basic unit of general scientific and professional cycles are mandatory and should be studied in the SPbSPU. The content and number of credit points of other disciplines units may vary within predetermined limits and, therefore, each of them can be recognised by partner universities. Experience in harmonization of curriculum for joint Master degree programme, meeting the requirements of Federal state standard, and the curriculum of partner university has shown that to obtain two degrees student are awarded with a few more than 130 ECTS.

Master thesis is carried out on the topic agreed by partner universities. Oral presentation of Master thesis is conducted in each of partner universities.

The most important component of the Master programmes in information technologies is a research work of the student. The topic research is determined by the professors of St. Petersburg State Polytechnical University and partner-university for each student individually at the beginning of the programme. The list of possible topics of students research work is as follows:

1. Machine learning;
2. Intelligent navigation systems;
3. Information security;

4. Intelligent adaptive control systems;
5. Industrial automation systems;
6. Robotic systems (industrial, mobile and hybrid robotics);
7. Decision making support systems, knowledge bases, expert systems;
8. Intelligent systems for signal and image processing;
9. Distributed Computing

Analysis of the employer's demand for graduates of double degree international educational programmes in the field of information technology has shown that graduates can successfully work in research institutes, enterprises, in the business, including foreign and joint organisations and companies. Graduates are well prepared to the PhD programmes in Russian and foreign universities.

Experience of joint double degree programmes implementation showed that developed materials and techniques can be successfully used in educational programmes such as summer and winter schools, research training programmes of students, international semesters, etc. and also can be the basis for innovative educational programmes in the field of information technology.

### **3 SUMMARY**

Developing of joint double degree programmes allow to provide academic mobility of the students and teachers of Russian and foreign partner universities, to stimulate the development of academic activities and technical infrastructure of partner universities, to improve the management of the educational process, to position partner universities as key institutions providing innovative methods of teaching and training.

We consider that using the experience of both developing programmes aligned with European standards and developing double degree programmes we can archive innovative results and new programmes that can be successfully implemented.

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