Introduction As a consequence of the ongoing integration processes in Europe the importance of academic mobility and sharing is increasing. Among other collaborative activities the number of joint-degree and double-degree study programs offered by universities worldwide is increasing. Jan Evangelista Purkyně University (further UJEP, www.ujep.cz) is a multidisciplinary university located in the city of Ústí nad Labem in the north-west of the Czech Republic (further CR). Faculty of Environment (further FŽP, fzp.ujep.cz) has been one of its founding faculties and since 1991 it served as the first faculty in the CR solely oriented on the environment and its protection. While the first research topics were focused on the local problems of severely polluted region (land reclamation after surface mining, pollution control etc.), during twenty-year history the research activities spread to wider environmental topics (environmental analytical chemistry, applied ecology, “green” technologies etc.). Consequently, new fields of studies were established and offered to students. Currently there are two study programs accredited in six fields of studies (3 BSc., 2 MSc., and 1 Ph.D. degree). One of recently introduced emerging fields was biotechnology. Since 2004 six biotechnological research projects (both fundamental and applied) have been resolved on FŽP UJEP (focused on industrial wastewater treatment, bioremediation of polluted soil, biosensing) and the research team has been established. As a logical next step research experiences should be transformed into education. In 2009 FZP UJEP jointed the consortium of universities from several Europian countries (Germany, Lithuania, Belarus, Russian federation) to resolve the TEMPUS REHAUT project (511426-TEMPUS-1-2010-1-RU-TEMPUS-JPCR: Reform der Hochschulausbildung in der Biotechnologie: Entwicklung und Modernisierung der BSc/MSc-Lehrangebote, i.e. Reform of the higher education of biotechnology: Development of new bachelorand master-degree study programs) funded by EU. The aim of the project is the development of the universal biotechnology study programs in BSc. and MSc. degrees and all fields of biotechnology including environmental biotechnology. Here we introduce the idea of preparation on new MSc. program “Environmental biotechnology” which is intended as double-degree on UJEP and KNRTU. The new program should be based predominantly on already accredited programs “Waste management” (UJEP) and “Ekobiotechnology” (KNRTU); comparison of compatibility of these two programs is the main aim of this contribution. Significance of new double-degree study program Desired accreditation of new double-degree program “Environmental biotechnology” will have several positive consequences for both UJEP and KNRTU. In CR such study program is missing. Czech study programs oriented on biotechnological are currently taught on six universities in 17 study programs and 32 field of studies (11 BSc., 17 MSc., 4 Ph.D.). Majority of the programs are oriented on general biotechnology or agricultural biotechnology. Only two fields are oriented on Environmental biotechnology: the study program “Environmental biotechnology” (Technical university of Ostrava) is accredited in bachelor degree only and master degree “Biotechnology and waste management” (Mendel University of Brno) has too narrow orientation. Since proposed program

“Environmental biotechnology” is intended in master degree and with wider orientation on all aspects of environmental biotechnologies, it should fill this substantive educational gap. With its area of high-quality agricultural soil, enormous natural resources, number of well-trained experts, and government-level priority, Russian federation is very perspective country for further development of all branches of biotechnology. KNRTU with its ~30 000 students is the biggest technological school in Russian federation and also one of the best rated. Thus its participation in the education is a guarantee of the program quality. KNRTU students will gain the opportunity of obtaining double-degree from two respected Russian/EU universities. Basic characteristics of compared study programs Both compared programs are designed for 4 semesters and are taught in accordance with Bolonga declaration. Study program “Waste management” is focused on all aspects of waste production, liquidation, handling from technological point of view as well as from legislative and economic points of view. The students have to gain 120 credits (60 per year) out of them 108 credits from obligatory subjects and the rest from elective subjects. The students find the jobs in wide industrial companies as well as in civil services. Study program “Ekobiotechnology” (see http://www.kstu.ru/updetail.jsp?idplan=4617 for details) is focused wider on all aspects of environmental biotechnologies. Students also have to gain 120 credits, out of them 100 from obligatory subjects. Comparison of study programs Subjects of “Waste management”, their compatibility with “Ekobiotechnology” and remarks of proposed harmonization steps are listed in Table 1. Elective subjects are by analogy listed in Table 2. Subjects of “Ekobiotechnology” that do not have its counterpart in “Waste management” are listed in Table 3. Overall the analyses revealed high compatibility of the two study programs: Within obligatory subjects there is a 57% credit harmony. Other 12% of credits belong to subjects that are included in “Waste management”, however they require enhancing. These are especially general subjects related to biotechnology (biochemistry, microbiology etc.) which stand somewhat in the background in “Waste management” but require priority in “Environmental biotechnology”. Approx. 17% of the credits might be easily harmonized. These are especially subjects related to analytical chemistry including laboratory training. They might be simply changed so as to become more “bio-“. Also legislative subjects fall into this category. Only 15% of credits are completely incompatible. These subjects should be eliminated so as to make space for enhancing of more important biotechnology-related subjects. Students, that gained one of FŽP UJEP BSc. degree, carry some of the knowledge already from their BSc. degree. This is especially case of environmentally oriented subjects. Significant portion of incompatibilities are based on the simple fact that FZP UJEP is an environmentally oriented faculty and study programs are thus more oriented on the environment while biotechnology related subjects are sidelined. FZP UJEP student also carry some of the environmental knowledge already from BSc. degree, while KNRTU students have to fill this knowledge gap in specialized subjects. Opposite is true for KNRTU students of

biotechnological BSc. programs, which carry some of the “biotechnology” knowledge from BSc. degree, while FŽP UJEP students have to chase this knowledge gap. This contradiction also lines the way of further harmonization. While KNRTU can offer more “biotechnology” skills and experts, FŽP UJEP will contribute to new common program on the “environmental” side. Matters of discussion are the elective subjects, which enable students to individualize their studies. Contemporary list of elective subjects of “Waste management” is currently quite long, especially when regarding recent decreasing number of program students due to demographic wave. Thus possible reductions of less popular subjects is currently under review. Future perspectives This preliminary comparison revealed a good compatibility of both analyzed programs. And since both UJEP and KNRTU are interested in preparation of the double-degree common program, its preparation has started. Here is a draft of how the new program “Environmetal biotechnology” could look: It should be based more on “Ekobiotechnology” since the topic is closer and also already accredited on KNRTU. Students should spend two whole semesters in Kazan and two in Ústí nad Labem. It was not yet decided whether the places of study will alternate after each semester or after year. Student mobility might be co-funded from running EU mobility projects as well as other sources. Split of the subjects between FŽP UJEP and KNRTU will be based on the detailed analysis of compatibility. In order to optimize the whole educational process, the subject split will take into account simultaneous co-teaching of the same subjects for students of different study programs. Diploma work should be prepared and final exams should be taken on the home institution (this does not eliminate the opposite opportunity). Study languages should be Russian and Czech. According to current Czech legislative, the use of Czech language is necessary in order to have the program funded by Ministry of education of the Czech Republic. If the studies were carried out in English (which would be clearly an interesting option worth discussing), the student would have to pay the full costs of the education. The working teams from FŽP started preparation of the details of the new study program. We hope to finish all the necessary work by the end of 2013. In 2014 a re-accreditation of all study programs will proceed on UJEP so the new study program should be accredited within this process. This would enable introduction of new students already from winter semester 2014. Acknowledgment The work was supported by the TEMPUS REHAUT project (511426-TEMPUS-1-2010-1-RU-TEMPUS-JPCR: Reform der Hochschulausbildung in der Biotechnologie: Entwicklung und Modernisierung der BSc/MSc-Lehrangebote). Table 1 - List of obligatory subjects of the study program “Waste management” and their comparison with “Ecobiotechnology” Abbr Subject C Y/Sem Compatibility, proposed harmonization 1GIS2 Geographical information systems 5 1/W Compatible 1MAN1 Environmental management I. 2 1/W Compatible 1NAPO Company teachning 3 1/W Absent - lower credits / exclude 1SOC Sociology 2 1/W Compatible 1BICH Biochemistry 2 1/W Already in BSc - enhance 1INAN Instrument analytics 2 1/W Different - adapt (more biotechniques) 1PT3 Cleaner and waste-limited technologies 6

1/W Compatible 1TOXI Toxicology 3 1/W Compatible 1ENIN Environmental informatics and reporting 3 1/S Compatible 1TEZA Technology of landfill safeguard 4 1/S Compatible 1MAN2 Environmental management II. 4 1/S Compatible - merge I. and II. ??? 1ACHZ Analytic chemistry of environment 5 1/S BSc - merge "Env. analytical chem." and "Bioanalytics" 1BIOT Biotechnology 5 1/S BSc. - Enhance / Split to more subjects 1HNO Assessment of waste hazardous properties 2 1/S Compatible 1ODP1 Wastes and secondary raw materials 4 1/S Compatible 1ENPO Environmental politics 3 2/W Lower credits / harmonize 1IPPC Integrated Pollution Prevention and Control 3 2/W Different - Harmonize 1LCA Life-cycle assessment 4 2/W Different - Harmonize 1CHD Chemodynamics 5 2/W Absent - Eliminate / Change / Integrate into Biochemistry 1EKZA Environmental burdains and decontamination technologies 3 2/W Accent bioremediation 1ODP2 Wastes and secondary raw materials II. 6 2/W Compatible 1BEPR Labour protection 3 2/S Compatible 1PSYR Psychology of management 3 2/S Compatible Abbreviations: Y/Sem – year/semester (W = winter, S = summer), C – credits, Table 2 - List of elective subjects of the study program “Waste management” and their comparison with “Ecobiotechnology”. Abbreviations are Abbr. Subject C Y/Sem Compatibility, proposed harmonization 1DTM Digital terrain models 2 1/W Absent - Substitute by modeling of biotechnological processes? 1TWS Creation of www pages 1 1/W Compatible 1GEO2 Environmental geology 4 1/W Absent – harmonize 1AOT1 Specialized text in English 1 1/W Compatible 1HOPZ Assessment and valuation of natural resources 5 1/W Absent – harmonize 1MAJ1 Specialized environmental English 4 1/W Compatible 1MANG Introduction into management 2 1/W Absent – harmonize 1ONI Specialized German 2 1/W Compatible 1RABE Radiation safety 2 1/W Absent – harmonize 1STAP Construction law 2 1/W Absent – harmonize 1DPZ Remote exploration of land 2 1/S Compatible 1INTE Dynamic internet technologies 1 1/S Compatible 1MOFY Introduction to modern physics 2 1/S Absent – harmonize 1ZMEI Display methods I. 2 1/S Compatible 1VREZ Water regimes of landscape 2 1/S Absent – harmonize 1AOT2 Specialized text in English II. 3 1/S Compatible 1MAJ2 Specialized environmental English II. 4 1/S Compatible 1ON2 Spcialized German 4 1/S Compatible 1PRVP Project management CR and EU 3 1/S Compatible 1RIAN Risk analysis 2 1/S Compatible 1UCET Introduction to accountancy and calculation 2 1/S Compatible 1PRZN Industrial regions and zones 2 1/S Absent - eliminate 1GIS3 GIS applications 2 2/W Compatible 1ZME2 Display methods II. 3 2/W Compatible 1PSY4 Environmental psychology 2 2/W Compatible as an obligatory subject 1STRO Introduction to mechanical and electrical engineering 2 2/W Absent - adapt to bioengineering??? 1PPOK Antiflooding precautions in landscape 2 2/S Absent – eliminate 1ETIK Ethics and aestethics 2 2/S Compatible Table 3 - List of subjects of the study program “Ekobiotechnology” that do not have its counterpart in “Waste management” Subject Remark Applied biochemistry Harmonize according to KNRTU Applied microbiology Harmonize according to KNRTU Introduction to biotechnology In BSc. Bioremediation techniques Partly in BSc. Bioremediation - field practices Harmonize according to

KNRTU Fytoremediation Harmonize according to KNRTU Bioanalytical methods Adaptation of contemporary analytical subjects Laboratories in bioanalytical methods Adaptation of contemporary analytical subjects Separation techniques Adaptation of contemporary analytical subjects Genetical engineering Partly within contemporary Biotechnology Bioengineering Partly within contemporary Biotechnology Mechanisms of pollutants biodegradation Harmonize according to KNRTU Hygienic aspects of biotechnologies Partly within contemporary Biotechnology and Microbiology Environmental information and reporting Partly in other GIS subjects in BSc. Biostatistics and chemometrics Partly in other BSc. subjects Xenobiochemistry Partly in Toxikology Applied enzymology Partly in Biotechnology Biochemistry of secondary metabolites Partly in Biotechnology Cultivation techniques Partly in BSc. microbiology Soil microbiology Parlty in BSc. microbiology Laboratories in Applied microbiology Harmonize according to KNRTU Biotechnological applications of microorganisms Harmonize according to KNRTU Waste-water treatment In BSc. Introduction to sampling of wastes. Included in waste-management subjects Project in Environmental biotechnolgoy Harmonize according to KNRTU Bioindication Harmonize according to KNRTU Modeling of biotechnological processes Harmonize according to KNRTU