

Cooperational Graduate Education Program for the Development of Global Human Resources in Energy and Environmental Science and Technology

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Abstract

“Cooperational Graduate Education Program for the Development of Global Human Resources in Energy and Environmental Science and Technology (EEST)” named as CAMPUS-Asia EEST has started among three consortium universities (Kyushu University, Shanghai Jiao Tang University and Pusan National University) at 2013 and successfully implemented targeting to award double master course degrees (DD) between two universities among three consortium universities within a normal enrollment period and with one master thesis written in English.

After 3 years of successful operation of the program, the 20 students have graduated the consortium universities with DD at February/March 2015. An important achievement of DD program is, in addition to awarding DD, that all the involved students have become good friends and known the other country better based on cross-cultural understanding, which is also the aim of the “Asian Future Leaders Scholarship Program” of the CAMPUS Asia. Moreover, they have learned to be expertizes in EEST. Quality Assurance is fully kept based on standard for awarding master course degree in each participating university.

Keywords: CAMPUS-Asia, Educational Program, Master Course, Double Degree, Energy and Environment

1. CAMPUS Asia program, a government supported program

“CAMPUS Asia (Collective Action for the Mobility Program of University Students)” launched at the first Japan-China-Korea Committee for Promoting Exchange and Cooperation among Universities at April 16, 2010. In the Second Trilateral Summit (Beijing, October 10, 2009), Prime Minister Hatoyama had proposed to hold an intergovernmental expert meeting in order to discuss quality-assured exchanges. Based on the agreement at the Second Trilateral Summit, developing exchange among universities with quality assurance in Japan, China and Korea is of great importance in implementing human resources development on a scale of the whole East Asian region as the economic activities in this region are becoming more and more interrelated [1].

(1) Objectives

CAMPUS Asia aims to promote cooperation among universities and mutual understanding among students of the three countries through various forms of exchange programs between universities, and ultimately contribute to strengthening the competitiveness of universities and nurturing the next generation of outstanding talents of Asia.

(2) Pilot Program

CAMPUS Asia shall be initiated through a pilot program, after which exchange programs of different types and levels shall be developed and the program scale will be expanded based on the experience accumulated from the pilot program. The present program reported here is one of 10 programs approved as for Type A-1 and started Oct. 2013.

2. CAMPUS-Asia EEST program aiming double degree

“Cooperational Graduate Education Program for the Development of Global Human Resources in Energy and Environmental Science and Technology (EEST) (referred as CAMPUS-Asia EEST, hereafter) performed by three consortium universities (Kyushu University (KU), Japan, Shanghai Jiao Tong University (SJTU), China and Pusan National University (PNU), Korea) was approved as one of 10 programs for Type A-1 and started Oct. 2013 with financial supports of respective governments of the three universities under the framework of CAMPUS Asia Project (2011 – 2015).

Objectives of CAMPUS-Asia EEST Program are development, implementation, and deployment of practical collaborative

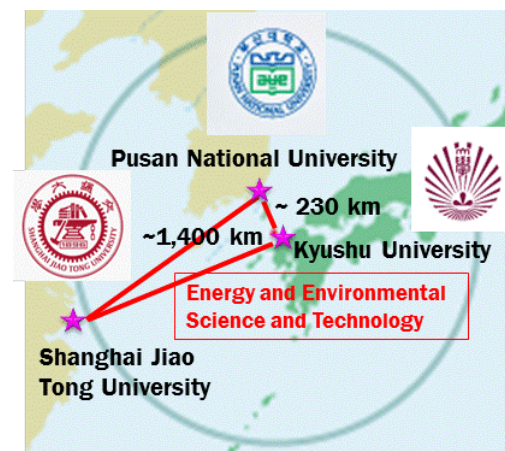


Fig.1 Three consortium universities establishing compact triangular alliance of graduate schools in Japan, China and Korea

educational programs in EEST where Asia should take initiative to lead the world.

The CAMPUS-Asia EEST program aims at developing “global human resources in EEST” with the following specific capabilities:

- (1) research and development capabilities based on the acquired in-depth knowledge and expertise;
- (2) understanding and analysis of the current state of environmental problems with an evolutionary approach (quantitative assessment, time-scale and place);
- (3) a good level of English ability required to work globally;
- (4) understanding of foreign cultures, people, and societies and ethics expected for international researchers and engineers in the age of globalization.

To realize these, a student exchange program aiming double degrees in master course between two universities among the three consortium universities was designed and concluded “Student Exchange Agreement/MOU aiming double degrees”. The details of the Course designs with quality assurance are in Sec.4.

3. Energy and Environmental Science and Technology (EEST) and Asia

In order to establish sustainable society by overcoming existing energy and environmental issues, not only the development of science and technology but also revolution of our consciousness and social system are indispensable.

Asia is the scene of ongoing energy and environmental issues

- Rapid economic growth
- Rapid increase in energy consumption
- Aggravating environmental pollution
- Restructuring initiatives and policies against energy and environmental issues

The measures/efforts against energy and environmental issues should be considered/discussed based on the understanding of current status, quantitative assessment, and consideration of time-scale and place with global eyes. Those are the main reasons for the cultivation of global human resources with specified capabilities given above who can actively participate in EEST field.

4. Objectives and Implementation

Most of plans and objectives mentioned in the initial proposals were implemented and achieved successfully.

Followings are summaries of the objectives and achievements of the CAMUS-Asia EEST program.

4-1 Content of the Exchange Program

Making student exchange agreement/MOU aiming double degrees (DD), a new education system was established at 2013. Afterwards, in every year, around each 5 students (total of 30 students) aiming DD have been exchanged among three universities in one semester. Accordingly, 20 students among the three universities have been successful graduated and awarded DD at February/March 2014. Similar number of students will continuingly graduate with DD.

To realize these, a new international course on Energy and Environmental Science and Technology (EEST) was established. And its curriculum was constructed to develop globally-competent human resources in EEST who possess:

- (1) highly specialized expertise and research development skill based on the expertise,
- (2) understanding of current energy and environmental issues and progressive investigation skill,
- (3) globally-competent English language skill,
- (4) professional ethics required for researchers and engineers in the globalized era as well as understanding of different cultures/races/societies.

Most of procedures to award DD are written in the MOU considering the quality assurance and accordingly implemented [2]. Some of the course programs, such like summer schools, are open for students in the consortium and other universities to enhance/encourage student exchange and cultivate more global human resources in EEST field.

4-2 Outcomes

The three universities (i) disseminate the program contents and related information to the public, (ii) jointly develop teaching materials, (iii) standardize teaching method/level/quality in the EEST course, (iv) examine each country’s legal system related to credit transfers, and (v) maintain strict graduation/diploma policy through joint review of grading and degree conferral.

The consortium universities have successfully established the EEST course and awarded double degrees to 20 students at 2014. Most of the first patch of DD alumni and alumnae are now employed in large or important companies and some go on doctor courses in EEST field. Thus the outcome is just as expected or more. Still to find true outcome, or to know how significant the future of the DD alumni and alumnae, more time is needed.

4-3 Cooperative System and Roles of Participating Universities

The PDCA LEADER Committee in the consortium and a subcommittee called PDCA committee in each university were fully established. The PDCA LEADER Committee and three PDCA



Fig.2 KU-DD students at graduation ceremony in PNU

committees have been working very closely in order to plan, run, evaluate and improve the program. In addition, an administrative office called Campus Asia Office is established in each university as well and is providing students with supports of university and daily lives. The three offices are working closely to help students in the program. This consortium has succeeded to develop a joint operation system for education and research in EEST with the main aim of cultivating DD students who are able to work globally in Asia and the world.

Each exchange student during his/her stay in the Host University is mentored or supervised by at least one assigned professor. Not only laboratory studies, which are mandatory in his/her course work, but also daily life of an exchange student are based on his/her stay at the laboratory of the supervisor. This makes the role of the supervisor clear and the exchange student easy to live in abroad. The supervisor works as a committee member to review and evaluate thesis studies of the exchange student to award master degree.

4-4 Framework for credit transfer, grading, degree conferral

Figure 3 shows the framework of the EEST Course to cultivate global human resources awarding DD in master courses of two universities among the three consortium universities with quality assurance. The program consists of (i) Specialized education curriculum, (ii) EEST curriculum, and (iii) Research for Master’s thesis. The first one, the specialized education curriculum, involves credit approval via the utilization of current credit transfer system. The core of this program, EEST curriculum, which is incorporated into each university’s curriculum, involves faculty members from the three universities so that it makes joint approval of credits possible and also enables to jointly confer a certificate of the completion of the program.

To enable to award DD, an appropriate and specialized mechanism was designed, including mid-term thesis presentation to be held during the second summer school and the establishment of an approval system where faculty members from the consortium universities are forced to join a final thesis examination/approval meeting. Based on this mechanism, the consortium has created a new system and procedure to award DD with full quality assurance from all the three consortium universities.

All necessary procedures of credit transfer including grading and degree conferral are clearly defined as shown in table 1 and their procedures are indicated in the MOU.

4-5 Curriculum

The curricula of the EEST course include lectures, seminars and laboratory works and are fully constructed together with evaluation methods to award credits. The course program consists of two parts; main part is course curriculum in major of each exchange DD student in his/her Home University, and the other in curricula specified to the EEST course, which are given in the table 2. That means all DD students have to earn 6 Credits in two summer schools and several Credits from the EEST course curriculum, in addition to regular curricula in the major of their Home University.

Attendance of two times of Summer Schools (SS) each for two weeks is essential. All subjects in SS focus to EEST. Students themselves design seminars for discussion and debate relating EEST. In addition, laboratory studies for a few students together enhance their motivation to learn. All exchange students from the three consortium universities gather and stay at the same place to study, discuss and debate in gropes with students from three countries (sometimes more from the outside). This is significant for all attending students. They become better in communications, sincere to hear others, highly motivated to study, which clearly appear in questionnaire investigations. Figures 4-7 are photographs of summer school activities.

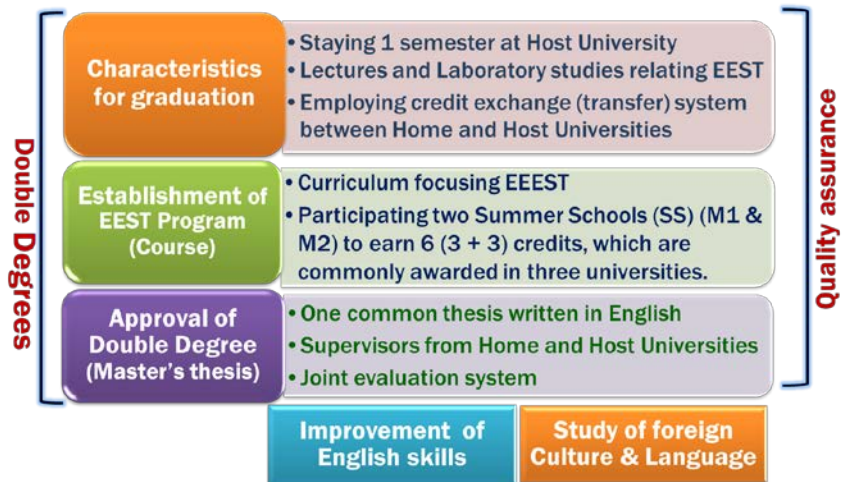


Fig.3 Framework of EEST Course to cultivate global human resources awarding double degrees in master courses of two universities among the three consortium universities with quality assurance.

KU		PNU		SJTU	
評点 Marks	Letter Grading	Marks	Letter Grading	Marks	Letter Grading
90-100	秀	95-100	A ⁺	96-100	A ⁺
		90-94	A ⁰	90-95	A ⁰
80-90	優	85-89	B ⁺	85-89	A ⁻
		80-84	B ⁰	80-84	B ⁺
70-80	良	75-79	C ⁺	75-79	B
		70-74	C ₀	70-74	B ⁻
60-70	可	65-69	D ⁺	67-69	C ⁺
		60-64	D ₀	63-66	C
				60-62	C ⁻
60 >	不可	Fail	F ₀	0-59	D
		不合格	Non Pass	N	
		合格	Pass	P	Pass

Table 2 Curricula specified to EEST course		
Class subject in EEST course	Credit	Remarks
Fundamentals of Energy and Environmental Science and Engineering I - Introduction to Energy and Environmental Science and Engineering -	1	1st Summer School
Fundamentals of Energy and Environmental Science and Engineering II - Basic Science and Technology for understanding of Energy and Environmental Science and Engineering -	1	
Laboratory Teaching on Energy and Environmental Science and Engineering	1	
Advanced Course on Energy and Environmental Science and Engineering I	1	2nd Summer School
Advanced Course on Energy and Environmental Science and Engineering II	1	
Advanced Seminar on Energy and Environmental Science and Engineering	1	
Research Seminar on Energy and Environmental Science and Engineering	2	EEST course
Environmental -friendly Fossil Energy Conversion	2	
Introduction to Solar Energy - Fundamentals, Technologies and Applications	2	
Foreign Language (Either Japanese, Chinese, Korean) for exchange students	2	In Host Univ.



Fig.4 Debate among Students



Fig.5 Lecture in Summers School



Fig.6 Field trip in Summers School

4-6 Admission and sturdy patterns

To award DD, exchange students must be admitted in two universities, a Host University and his Home University as well. Because of the difference in enrollment time among the three universities, starting time of admission is also different with each other. In the Figs. 8 and 9, as examples, study patterns are shown for SJTU and KU students, respectively. As seen fig. 8, SJTU DD students are admitted to SJTU as their Home University at September and study for one semester. Then, they are admitted to KU as their Host University in next April and study one semester. Afterwards, they return to the Home University for remaining three semesters. If they succeed to fulfill required conditions to get diploma and get DD, they will graduate from SJTU and KU in their second February and second March respectively within their normal enrollment periods. While the study pattern of KU DD students is a little different in their enrolment period, because of the delay in their admission time in SJTU as shown in fig. 9. Correspondingly the enrollment period of KU DD students in SJTU are shortened to one and half years.

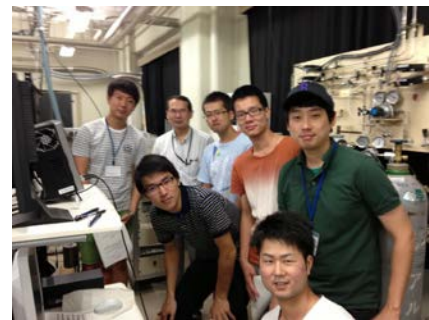


Fig. 7 Laboratory study in Summer School with a tutoring professor

To fulfill required condition (30 Credits both in KU and SJTU) for diploma in the Home University is not so difficult, while it is hard in the Host University and Credits transfer is essential. During the stay at the Host University, a DD student shall earn more than 14 Credits. In two times of summer schools, he can get 6 Credits. Transfer of 10 Credits from the Home University to the Host University makes fulfilment of the required 30 Credits.

4-7 Student Support

The DD program has been operated under the MOU, in which a tuition waiver clause is applied so that exchange students have no burden of paying for tuitions to their Host universities. The Campus Asia Office, of which all staffs speak English fluently, is established in each university and is offering uniform coordination of student support for learning and daily life. Moreover, some CA staffs in a Host university are fluent in Chinese and Japanese, Korean and Japanese, or Chinese and Korean, and solve complex problems easily with using mother language of an exchange student in trouble.

4-8 Language

The language used in the program is English. To make communication in English easier, special English courses are provided for all students belonging to the EEST course to improve/brush up their English language skill. Moreover, not only lectures given in English but also daily lives with English during the stay in their host university have significantly improved English communication skills of exchange students.

4-9 Monitoring & Evaluation / Feedback

The program monitoring and evaluation have been performed through the establishment of (1) an in-house evaluation system based on the multilateral cooperation among the PDCA LEADER Committee and three PDCA committees, and (2) an external evaluation system, including external review committee and student survey.

National Institution for Academic Degrees and University Evaluation (NIAD-UE), Japan, continuously monitors the CA program to find good practice and the results are given in its web page. [3] Revision and improvement considering answers to questionnaire given to all students are always made. With the above feedback systems, the program results in progressive improvement.

4-10 Publicity/Dissemination

Websites rich in contents such as given as,

Homepage <http://www.tj.kyushu-u.ac.jp/campus-asia/>

Facebook <https://www.facebook.com/kucampus.asia>

are developed, and with the utilization of the website, the three universities strive to disseminate information to the public. Also, the consortium or two or more consortia plan to organize a symposium, through which the universities should be able to communicate with the public. Some students, who had graduated at some university other than the three universities and have enrolled with their plan to be an exchange student of the CA program, were motivated with watching those web sites.

Concentrated courses in Summer School and/or Spring Seminar, which are mandatory for DD students to attend, are open for students not only in the three Universities but also in universities outside of the consortium even in the Asian countries. Consequently, more than 700 students in gross number have joined and enjoyed the international exchange

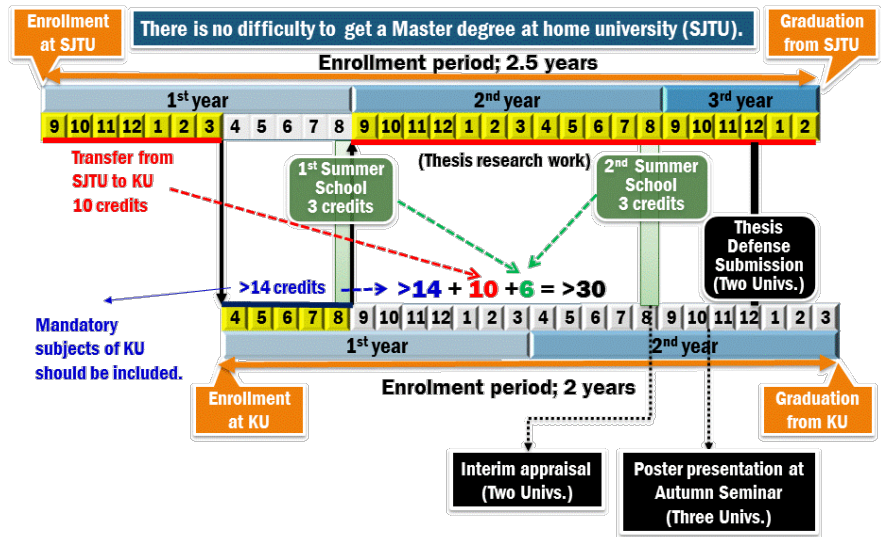


Fig. 8 Study pattern of SJTU DD students to get DD from SJTU and KU

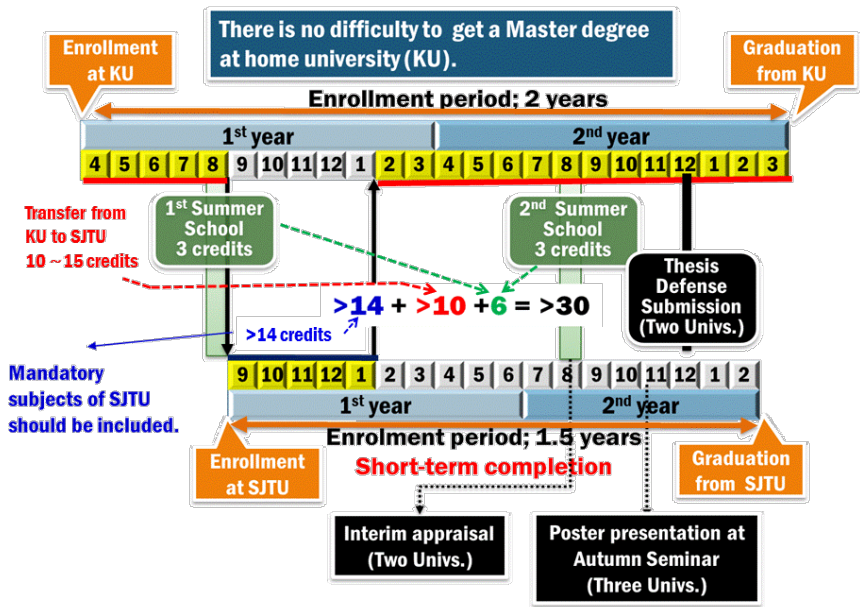


Fig. 9 Study pattern of KU DD students to get DD from KU and SJTU

program.

4-11 Cooperation with other institutions (local governments, NGOs, enterprises etc.) and Support from them

As EEST is closely tied with industry and local government, a co-operative system, where internship and practical classes taught by lecturers from the industry has been established. In every summer school and spring seminar, scientific tours or field trips to some industries, companies or monumental places are included in its curriculum. Moreover, in order to make their attendance of the program to be global career path for the students, the consortium is trying to create a system in which studying overseas is highly recognized by the industry and regarded as one of pros, not cons, of job hunting and employment. Letters of nomination indicating the attendance to the program have really helped students' job-hunting.

5. Conclusion

“Cooperational Graduate Education Program for the Development of Global Human Resources in Energy and Environmental Science and Technology (CAMPUS-Asia EEST)” has started as a pilot program in three consortium universities (Kyushu University, Shanghai Jiao Tang University and Pusan National University) to award double degrees (master degree) in the EEST field in two universities within a normal enrollment period and with one master thesis written in English.

- (1) Making student exchange agreement/MOU aiming double master course degrees (DD), a new education system, CAMPUS-Asia EEST, is implemented at 2013.
- (2) In every year, around each 5 students (total of 30 students) have been mutually exchanged among the three consortium university in one semester. Accordingly, 20 students (9 from KU, 7 SJTU and 3 PNU) were successful graduated with DD from the two universities among the three consortium universities at 2014. In 2015, the total of 35 students (KU 12, SJTU 12, PNU 11) enrolled at 2014 will graduate with DD.
- (3) To widen the program, some of EEST course programs, such as Summer School and Seminars in spring and autumn, are widely open for non-DD students in the three universities and even students outside of the consortium. Within four years from the program starting, more than 700 students in gross numbers have been attending the exchange program.
- (4) An important achievement of DD program is, in addition to awarding DD, that all the involved students have become good friends and known the other country better based on cross-cultural understanding, which is also the aim of the “Asian Future Leaders Scholarship Program” of CAMPUS-Asia. Moreover, they have learned to be expertizes in EEST.
- (5) Quality Assurance is fully kept based on standard for awarding master course degree in each participating university.
- (6) However, the present program shall terminate at April 2016 due to the termination of governmental support. The DD pilot program can be transformed to be a regular course, if any other budget, foundations and/or universities themselves support it.
- (7) Three universities highly desire to continue the CA DD program as a regular course.
- (8) The DD program has been established quite well and any two universities can employ or follow this program to establish DD courses between them.

References

1. <http://www.mext.go.jp/english/highered/1303550.htm>
2. <http://www.tj.kyushu-u.ac.jp/campus-asia/> and <https://www.facebook.com/kucampus.asia>
3. <http://www.niad.ac.jp/english/campusasia/>

Biography

T. Tanabe, Prof. Interdisciplinary Graduate School of Engineering and Sciences (IGSES), and the coordinator of the CAMPUS-Asia EEST, Kyushu University (KU)

Y. Teraoka was the leader of the CANPUS-Asia EEST, KU. He led everything on the CAMPUS-Asia EEST program from planning to implementation. Very unfortunately, he passed away at July 2, 2014. Afterwards, Prof. H. Nakashima took over his position.

H. Nakashima, the present leader of the CANPUS-Asia EEST, KU, the previous Dean of IGSES, KU.

W. Dong, Associate Prof. and an academic staff of the CAMPUS-Asia EEST, KU.

J. Park, Associate Prof. and an academic staff of the CAMPUS-Asia EEST, KU.

A. Harata, Dean of IGSES, KU