Current Status of Electrical Engineering Education in China

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Abstract: Briefly introduce the EE education nowadays in China. Instead of the narrow and deep educational plan of different specialties in the past, now emphasize more on the fundamental and basic courses given and the independent ability cultivated. Large amount of graduates with the BS, MS or PhD degree are welcomed local or abroad for the rapid development of advanced power industry in China.

1. Big demand to EE graduates

As we had mentioned on the International Exchanging Session, ISEIM, 2005, Japan [1], the big demand of electric power and so in China hope more and more qualified graduates of electrical engineering to join this important and interesting work. It means not only the quantity of EE graduates with different degree but also the quality of these students will be further enhanced. So a lot of hard work of reconstruction and improvement had been finished and will be finished for Chinese universities. As shown in Fig.1, both the total generating capacity and the annual power generation in China is increased rather rapidly, for instance, recently the annual increasing rate of power generation is more than 10%. Although there was a rapid development of power industry in China, the phenomena of lack of electricity is still very serious, almost all over the country. As the quick development of both industry and agriculture as well as the big changing of living condition, they all require more and reliable power supply. So it is necessary to build more advanced and large power stations and transmission/ distribution systems. For instance, the 500 kV AC and ±500 kV DC transmission lines had been used successfully, and the first AC 750 kV transmission line had been put into operation in the Northwest China recently based on the experience of Korea, Russia, United States, etc. And the first AC 1000 kV transmission line for China will be built in 2007 as well as the first DC ±800 kV line in 2008.

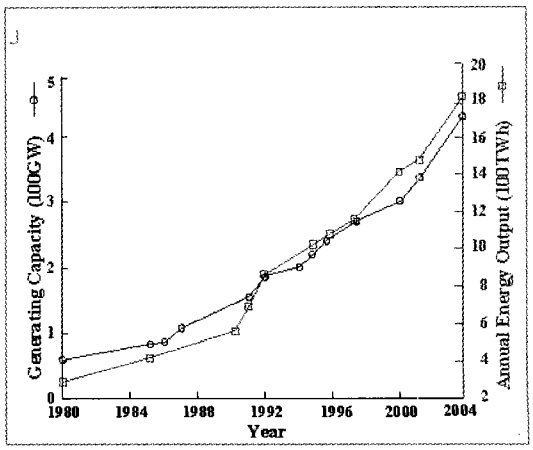

Fig.1 Trend of power industry in China

In order to finish so much hard and advanced topics, besides still learning more from other developed countries, it is very important to cultivate more and more good EE students with different degrees.

As it is not easy to build many new qualified universities within a short period, so the main job is putting on the universities existed. In fact, more financial support from government had paid to improve the condition of education and research.

For instance, one of the authors entered Jiaotong Univ. (that time in Shanghai) in 1950, and at that time the new students of our EE Dept. for each year was only 40, including that of power engineering and communication. However, nowadays there will be about 680 new students every year entering to the EE School of Xian Jiaotong Univ., including 400, 250 and 30 students for the BS, MS and PhD, respectively.

2. EE educational program

2.1 Educational system

In China, the compulsory education is 9 years, including 6 years of primary school and 3 years of junior school. And after graduated from 3-year senior school, the student may take the entering exam of university. For instance, 4.5 millions students will be entering different universities within the 8 million candidates in 2005.

In China, most universities are public. And the public universities have the financial support from the government, so the tuition fee is not high, for instance, about 1000 US dollar per year for an undergraduate. And there are still many scholarships for those excellent students.

Generally, it will take 4 years to obtain the BS degree, and after that 2.5 years for MS, another 3 years for PhD if the student is hopeful and able to learn more. To encourage more students to get higher degree, it is unnecessary to pay tuition fee during the period of their MS or PhD study. Moreover, the graduate students will get some financial support from government every month. After graduated from university, the students with MS or PhD degree will get higher salary than that with BS degree generally. Therefore, more students joined the MS entering exam recently. For instance, in our EE School, about 40% - 50% BS graduated students join the MS entering exam, and about half of them will have the chance to enter the graduate study, either still study in the same university or go to other university or research institute. In China, there is the graduate school in the most universities.

The 2-semester system is adopted in China. For instance, the summer and winter vacation is lasted about 6 and 5 weeks respectively, so the educational period for the autumn and spring semester is about 20 and 21 weeks respectively.

2.2 Educational plan of EE

During the 1950s, the educational system of Soviet Union that time had been introduced to instead our old system. So a more narrow and deep educational plan had been adopted, for example, many specialties had been founded within our EE Dept, including the specialty of electric machine, electric apparatus, high voltage technology, electrical insulation, automation, power system, electrical measuring technology, etc. and there were different educational plans for the students of different specialties.

With the rapid development of industry and new technology, especially with the open market policy, the disadvantage of that system was more obvious. And the idea for emphasizing the basic and fundamental education combined with the new technology as well as for cultivating better ability to work and create has been adopted. As an example, a brief list of undergraduate courses of our EE School was shown in Tab.1.

Tab.1 Undergraduate courses of EE

No.	Courses group	Required or elective	Credits	
			R	E
1	National defense & Politics	R	15	
2	Social science & Management	R/E	3	4
3	Physical culture	R	4	
4	English	R	14	
5	Natural science	R/E	27.5	14
6	Basic courses of EE	R	19	
7	Fundamental courses of specialties	R/E	23.5	26+
8	Practice & Experiment	R/E	20	10
	Total		126	54+

Generally, after listened each 16 hours of lecture or joined 32 hours of practice or experiment and passed its test, the student can get 1 credit. So within the total 180 credits mentioned above (126 for required and 54 for elective courses), the main time is concentrated on the lectures and experiments of natural science, EE basic courses and fundamental specialized courses, as the No. 5, 6, 7 and 8 shown in Tab.1. And the detailed courses of these groups were shown in Tab.2. In order to introduce new technology and new development of EE, there are 45 specialized courses opened to the student for choice, and the student can choose about 10 courses according to his/her interest for getting the 26 credits. And the professors will help the students as the supervisors. As there are more than 40 professors and more than 70 associated professors in our EE School, and a lot of research topics have been achieved by them, so they may give many advanced lectures for the graduate and the undergraduate students.

Tab.2 List of courses group No. 5, 6, 7

Courses group	Name of courses	Credits	
		R	E
Natural science	Advanced math	18	5
	Higher physics	9.5	
	Engineering chemistry		3
	Courses of other dept.		6
EE basic courses	Electric network	4.5	
	Analog & Digital electronics	8.5	
	Signal and system	4	
	Engineering drawing	2	
Fundamental courses of specialties	Electromagnetic field and wave	4	
	Electric machine	4.5	
	Power electronics	3	
	Automatic control	3.5	
	Introduction of EE	3	
	Modern measuring technique	2.5	
	Microcomputer and interface	3	
	A lot of specialized courses for choice		26+

As to be a good engineer or researcher, the ability of independent work and create is also very important. So a lot of practices and experiments must be finished by the students themselves. Moreover, in the last half year before graduation, each student must join a project supervised by a professor, and write a dissertation based on the project or research joined. Only after got required credits and passed the reply of dissertation, the student can get his/her BS degree.

2.3 Graduate study of EE

Students may get their BS degree by either full time or spare time study. The latter is also a good way for the continuing education; however, it will be more

hard work for these students.

As mentioned before, now many graduated students with BS degree may begin their MS study if they passed the entering exam of MS. But we prefer to accept the students with more experiences. Actually, if they had worked several years after they got their BS degree, they have not only more practical experience collected, but also more strong aspiration to learn. So many universities allow the experienced graduated students entering the MS or PhD study even with a little lower marks than those just graduated.

The courses for MS or PhD degree are only several, and the most is related to the advanced knowledge and new technology. Tab.3 shows an example of MS courses of HV Engineering in our university. Generally, it is only 30% and 20% time of education plan for the courses of MS and PhD study respectively. That is to say, the 70% or 80% time of their study is to join research, write papers and dissertation. Moreover, within their courses studied, self-study is more appreciated, as it is helpful for cultivating more ability to work independently. And it is very important to cultivate their creative ability also.

Tab.3 MS courses of HV Engineering

No.	Name of Course	Required or elective	Credits	
			R	E
1	Dialectics & Philosophy	R	3	
2	Foreign language	R	6	
3	Computing method	R	3	
4	Microprocessor control system / Software engineering	R	3	
5	Advanced network theory / Advanced electro-magnetic field theory	R	4	
6	Specialized courses of HV technology	E		9+
7	Lectures of other dept.	E		2
8	Practice	E		2
	Total		19	13+

The number of students joining the PhD entering exam is less than that of MS. For instance, in our EE School now, there are about 1600 students for BS, 700 students for MS, and 100 students for PhD. In general, compared with MS degree, if there is no a higher level dissertation along with some qualified papers published domestic and abroad, it will be very difficult to get a PhD degree. And we encourage the PhD students to join more domestic and international conferences with their papers of high level.

With the development of Chinese economy and technology, more and more foreign students come to Chinese universities, especially at the cities near the east coast. And the increasing rate of oversea Chinese graduates coming back to China is much more than the rate of Chinese students going abroad.

3. Discussion

With the open policy and rapid development in China, it is necessary for more qualified engineers and researchers. So it is a heavy duty for Chinese universities. And the foreign experts and their experience are very welcomed also.

In order to cultivate more qualified graduates in EE, there are many problems that we are facing, as mentioned before [1].

1) Recently, more students prefer to learn international business or trade, computer science, etc. rather than the electrical engineering. So the marks of entering exam of EE students are lower than the formers. It is necessary to attract more excellent students to enter the EE dept. Actually,

many senior school students prefer to play electronic games and hope to learn computer science or so, as they don't know the computer and automation had been introduced and used for many other areas, and the courses about computer and automation also belong to the basic courses of EE, as shown in Tab.2 and Tab.3.

2) Although there are English language courses in the primary and middle schools in China, a big part of time is still paid for the English language further in university. However, as the total learning time is fixed, so there is less time for the students of non-English speaking countries to learn more knowledge about science and technology. It will push us to improve our education plan further to cultivate qualified graduates within this limited time.

3) With the rapid development of industry, science and technology, what contents should be chosen preferentially is a serious problem for universities, and for EE dept also. For instance, many basic and theoretic contents, although not new, are still very important for the new generation. So, how to improve the textbooks and lectures in order to help the students to grasp these main basic courses in less time? As to the new technology, the employers that the graduates will be worked for hope these graduated students to grasp more technology just they will be using there, but it is impossible to learn each new technology in detail for all the students in university.

On the one hand the student must learn the basic knowledge and the introduction of modern technology, and on the other hand it is very important to cultivate the students the ability to work independently and creatively.

[Reference]

[1] Z. Yan. Problems during the Development of Insulation Technology. 2005 International Symposium on Electrical Insulating Materials, June 2005, Kitakyushu, Japan.

Authors

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