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ENVIRONMENTAL ENGINEERING EDUCATION IN IRAN: NEEDS, PROBLEMS AND SOLUTIONS

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Abstract

Since public concerns about the environmental issues have increased, several universities all over the world have been establishing environmental engineering programs. Environmental engineering programs in Iran at graduate level have been developed since 1990. At the present time, there are ten universities are presenting environmental engineering programs at graduate levels. The environmental engineering education systems of almost all Iran universities are quite traditional. As the environmental engineering problems have become very diverse and complex, it is necessary to define the new scope of environmental engineering, especially in developing countries, to cope with environmental problems and sustainable development concerns. Therefore, the Environmental Engineering programs of Iran Universities must be modified in the near future. For example several courses such as "Green Chemistry", "Energy Management", "Environmental Law", "Environmental Economics" and 'Environmental Ethics and Philosophy", " Environmental Sociology" and "Sustainable development" are suggested to add to the curriculum of the all environmental engineering programs in Iran. The aim of this paper is to explain the present situation and challenges of environmental engineering education in Iran.

Keywords: environmental engineering, education, curriculum, course development, Iran

1. Introduction

"Engineering" may be defined as the application, under constraints of scientific principles to the planning, design, construction and operation of structure, equipment and system for benefit of society (Sincero and Sincero, 1996). Environmental Engineering is defined as " that branch of engineering that is concerned with protecting environment from the potentially deleterious effects of human activity, protecting human populations from the effects of adverse environmental factors and improving environmental quality and for human health and well-being" (Peavy et al., 1985).

Environmental engineering, which was traditionally a sub-set of civil engineering focusing on water sanitation, has mushroomed to include all aspects of human and terrestrial environment water and wastewater management, air quality, solid and hazardous waste management noise and light pollution, and radioactive waste management (Bishop, 2000). So, environmental engineering covers a broad spectrum of environmentally related activities.

Nowadays, environmental issues affect almost all commercial and industrial sectors, and are a central concern for the public, governments, and even international relations. The main environmental issues of the present age are safe drinking water, wastewater processing, solid and hazardous waste disposal, outdoor and indoor air pollution, ecological risk management, and pollution prevention through better, safer products or improved process design. (EVEN, 2003).

Since public concerns about the environment issues have increased, several universities have been establishing environmental engineering course in both developed and developing countries. Environmental engineering education program of developed country have changed over the past several decays. For example in US this program passed three following steps: First step (Before 1950): mainly focus on

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engineering practice, using uniform design codes and traditional design procedures; Second step: more scientific based approach, in which a fundamental understanding of natural phenomena was emphasized; Third Step: More holistic approach to understanding environmental processes and design of environmental systems (Bishop, 2000).

On the other hand the environmental engineering education program of the most universities of developing countries is quite traditional. It is necessary for these universities to modify their curricula. The main aim of this paper is to explain the present situation and challenges of environmental engineering education in Iran.

2. A brief history of higher education in Iran

The history of the establishment of academic universities in Iran dates back to 1851 with the establishment of "Darolfonoon", aimed at training and teaching Iranian experts in many fields of science and technology. It was in 1928 that Iran's first university (The University of Tehran) was proposed by an Iranian physicist, Mahmoud Hessaby which was built in 1934. The main purpose of the establishment of the University was to disseminate advanced knowledge in relation to the sciences, technology, literature and philosophy (Higher Education, 2006; Higher education in Iran, 2006). The first university of Iran (University of Tehran) started its activity by establishment of the following six faculties (History, 2006): 1) Theology, 2) Natural science and Mathematics, 3) Literature, Philosophy and Educational Sciences, 4) Medicine and its various branches, 5) Law, Political Science and Economics, 6) Engineering. In 1934 only 40 students were admitted to the engineering faculties of the University of Tehran in the fields of civil engineering, mechanical engineering, mining engineering and electrical engineering fields (History of UT, 2006).

Since the Islamic Revolution of 1979 in Iran, the educational system of the country has gone under qualitative and quantitative changes. The two Ministries responsible for higher education in Iran are the Ministry of Science, Research and Technology (MSRT) and Ministry of Health and Medical Education (MHME). Presently, 54 universities and institutes of higher education and 42 medical schools are active under the MSRT and MHME, respectively. In addition, Islamic Azad University; as the first private university in Iran, is presently active in over 110 cities in Iran with more than half a million students (Education System, 2006; Higher Education, 2006; Higher Education in Iran, 2006).

3. An overall review on environmental education programs in Iran

Nowadays, environmental issues affect almost all commercial and industrial sectors, and are a central concern for the public, governments, and even international relations. There are several Universities in Iran that are presenting different programs related to Environmental Science and Engineering. Different Faculties, Schools and Departments are currently offering Associate Diploma, BSc, MSc. and PhD degrees in various subjects related to environment, which are shown in Table 1.

In this paper the mainly focus is put on the environmental engineering programs that are offering by Engineering Departments.

Table 1. Environmental educational programs in Iran*

Name of Department/ Schools/ Faculties	*Offered Degree*	*Authorized by*	*Main Universities*
Department of Civil Engineering	MSc and PhD in Environmental Engineering	MSRT	Sharif University of Technology, Amirkabir University of Technology, Tarbiat Modaress University, Iran Universty of Science and Technology, Khaje Nasir University of Technology, The University of Shiraz, Isfahan University of Technology
Faculty of Environment	MSc and PhD in Environmental Engineering, MSc in Environmental planning and Management, Msc in Environmental design	MSRT	The University of Tehran
Department of Chemical Engineering	MSc and PhD in Environmental Engineering	MSRT	Sharif University of Technology
Faculty of environmental resources	BSc and MSc in Environmental Science	MSRT	The University of Tehran, Tarbiat Modares University, Isfahan University of Technology
School of Public health	Associate Diploma, BSc, MSc and PhD in Environmental health	MHME	Tehran University of Medical Sciences, Isfahan University of Medical Sciences, Iran University of Medical Sciences

MSRT = Ministry of Science, Research and Technology (Iran)
MHME =Ministry of Health and Medical Education (Iran)
* Non-governmental Universities (Islamic Azad Universities) are not included in this list

There is no BS level of Environmental Engineering in Iran now. Environmental engineering program at graduate level have been developed since 1990 in Iran. At that time only two universities (The University of Shiraz and Tarbiat Modares University) offered MSc of environmental engineering in Iran and only a few students admitted in these programs. For example in 1990 only three students were accepted as Master students of Environmental Engineering at Tarbiat Modares University. At that time the entrance exam for MSc of environmental engineering was separated from other fields of civil engineering and admitted students had different backgrounds such as civil engineering, chemical engineering and irrigation engineering.

Presently, there are ten universities in Iran (except non-governmental Universities) that are presenting environmental engineering courses at the graduate levels which are accepting more than 90 master students per year (Table 2).

Table 2. Number of student admitted for MSc degree of Environmental engineering in 2007*

No.	*University*	*Department / Faculty*	*No. of student admitted*
1	Sharif University of Technology	Civil Engineering	11
2	Amirkabir University of Technology	Civil and Environmental Engineering	10
3	Tarbiat Modaress University	Civil Engineering	8
4	Iran Universty of Science and Technology	Civil Engineering	8
5	Khaje Nasir University of Technology	Civil Engineering	10
6	Shiraz Universty	Civil Engineering	5
7	The University of Tehran	Faculty of Environment	20
8	Tarbiat Moalem University	Civil Engineering	10
9	Mazandaran university	Civil Engineering	6
10	Ferdowsi University (Mashhad)	Civil Engineering	6
Total		94	

*Adopted from Guideline MSc (2007), Ministry of Science, Research and Technology.

At present the admitance exam of environmental engineering is the same as other fields of civil engineering and therefore more than 90 percent of admitted students have civil engineering background.

Among ten above-mentioned Universities, two of them (Tarbiat Modaress University and The University of Tehran) have PhD program of Environmental Engineering in Iran. Therefore, only a few of master students are accepting for PhD program.

The number of Universities in Iran offering Ms and PhD of environmental engineering is not acceptable in compared with the Universities of developed countries. For example there are approximately 140 Universities in North America offering MSc. and PhD (Bishop, 2000).

As an example of environmental engineering education in Iran, the curriculum of the department of civil and environmental engineering at Amirkabir University of Technology (AUT) for Master program is explained hearafter.

4. Environmental engineering education in the Department of Civil and Environmental Engineering, Amirkabir University of Technology (AUT)

Civil and Environmental Engineering (CEE) Faculty of AUT established MSc degree of environmental engineering in 2003. At the same time, the name of the "Department of Civil Engineering" was changed to the "Department of Civil and Environmental Engineering (CEE)". The main objectives of the environmental engineering program at AUT are to provide environmental engineering education for the students who have different backgrounds (Civil engineering, Chemical engineering, Mechanical engineering and so on) at the graduate level.

The MSc educational program of Environmental Engineering including all fields and the courses (including main and elective courses), offered by the CEE Department of AUT, is shown in Fig. 1. According to this program, students can select their fields of study after the 2nd semester. After that, the students will choose at least three elective courses with the approval of their supervisors.

Full-time master students of Environmental Engineering will normally be expected to finish their degree in 2 or 2.5 years (4 or 5 semester) by completion of a minimum of 30 credit units, and a thesis (6 credit units).

There are not big differences between MSc curricula of environmental Engineering in AUT and other Universities in Iran. Some Universities such as Sharif University of Technology replaced the "Advanced Mathematics" course by "Environmental Planning and Management" course for their MSc Program. In addition, there is a difference on elective courses offering by each department that are mainly depends on the professional fields of academic staff.

5. Challenges of environmental education in Iran

Nowadays, the environmental engineering problems have become very diverse and complex. For this reason, it is necessary to define the new scope of environmental engineering to cope with environmental problems and sustainable development concerns, especially in developing countries.

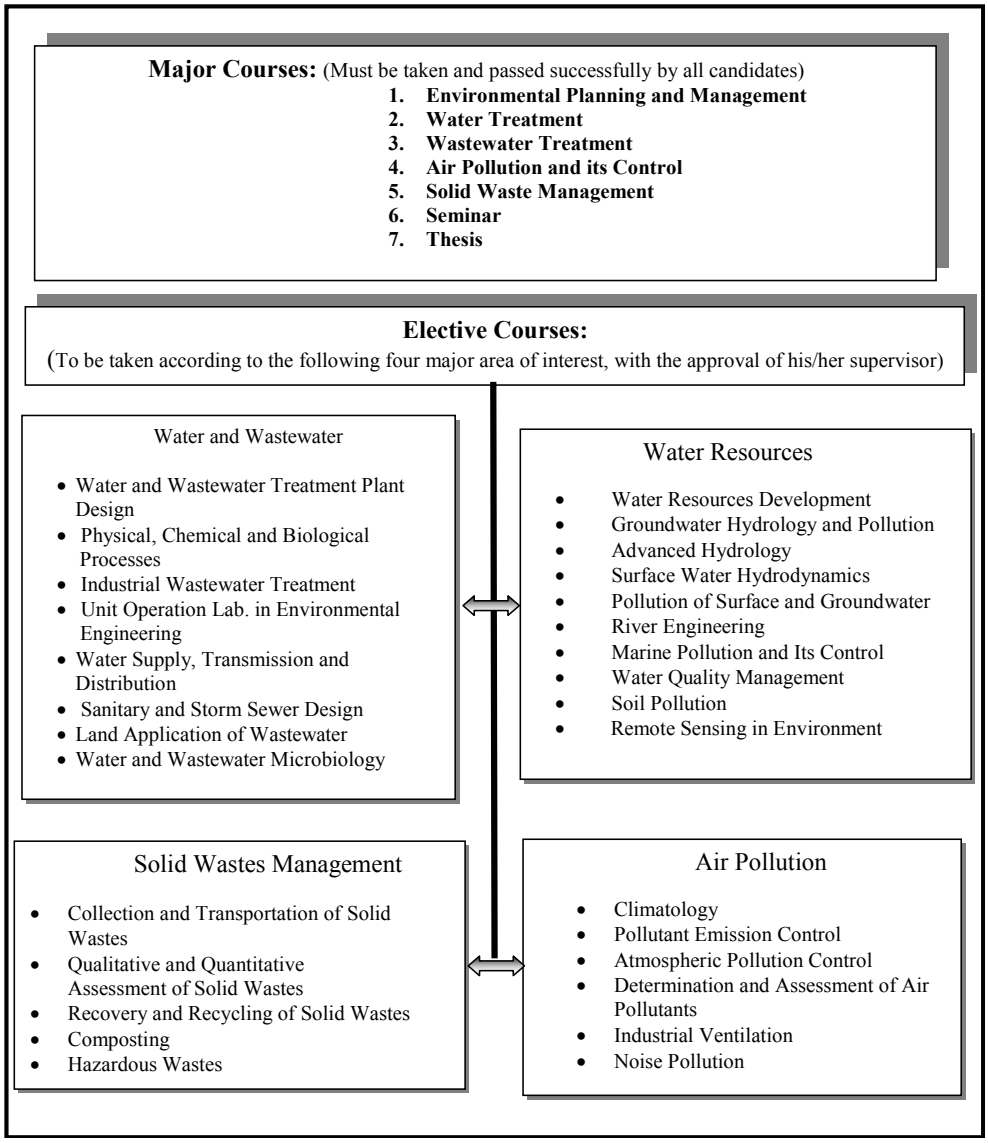

Fig. 1. MSc educational program of Environmental Engineering in Department of Civil and environmental Engineering (Alavi Moghadam et al., 2004; Curriculum Book, 2003)

On the other hand "the complex nature of the environmental problems of the present age implies the necessity for collaboration among engineers, social and natural scientists, economists" (Mino, 2000). Unfortunately, integration of the engineering curricula with social, cultural and economic sciences is not started in any fields of Engineering in Iran. So it is crucial for all Universities in Iran (especially environmental engineering fields) to modify their curricula to achieve the main sustainable development goals.

It is no doubt that the traditional program of environmental engineering cannot cope with the complex nature of the present environmental problems of developing countries. The Environmental Engineering departments of Iran's Universities should modify their curriculum by adding several new and multidisciplinary courses in the near future. Several courses such as "Green Chemistry", "Energy Management", "Environmental Laws", "Environmental Economics" and 'Environmental Ethics and Philosophy", " Environmental Sociology" and "Sustainable development" are suggested to add to the curriculum of the all environmental engineering program as elective courses in Iran. By adding these courses, all other engineering students (both undergraduate and graduate levels) can have this chance to take part in these interdisciplinary courses. It is not so easy to introduce these lectures in graduate program of Environmental engineering in Iran mainly due to lack of academic staff in these multidisciplinary fields.

The Universities should promote their activities toward sustainable development. One of the main fields that can promote a society toward sustainable development is "environmental engineering". According to the article 65 of 4th development plan of Iran (2005-2009), government is urged to prepare regulation regarding sustainable development path for all ministries, universities, and

other organization. It will be a good chance for universities to enhance their activity for establishment of different related fields e.g. environmental engineering and science. The government is encouraging these activities in universities by introducing some University as "Green University". For example based on AUT activities toward sustainable development, it was approved for this university to be "Green University" in 2003 by Iran Ministry of Science, Research and Technology as well as Department of Environment. Therefore, AUT as one of the main technical universities in Iran has chosen the strategy "pioneer of Sustainable Development in Iran" for the next decade (Alavi Moghadam et al., 2004; Alavi Moghadam et al., 2005)

Environmental Engineering education in Iran is at the beginning of way and there are a lot of obstacles for promoting these fields of study. The main obstacles are summarized as:

1) The budget limitation for establishment of environmental engineering programs in Iran's Universities.

2) Lack of academic staff in different new field of environmental engineering.

3) Lack of professional jobs for environmental engineering gradutes due to weak legislation for environmental protection.

4) Lack of long- term planning for environmental engineering education program in Iran

5) Lack of International collaboration among the universities of Iran and developed countries

6) Difficulties in official procedure of establishment of new fields in Iran's Universities.

7) Lack of professional organization to audit and evaluate the environmental engineering programs in Iran.

6. Conclusions

Environmental engineering program at graduate level have been developed since 1990 in Iran. At the present time, there are ten universities in Iran that are presenting environmental engineering program at the graduate levels. The numbers of graduated students of this field are dramatically increased within past few years. The environmental engineering education system of almost all universities in Iran is quite traditional and it should be modified in the near future according to the public needs and concerns.

It is necessary to define the new scope of environmental engineering to cope with environmental problems and sustainable development concerns, especially in developing countries. Several courses such as "Green Chemistry", "Energy Management", "Environmental Laws", "Environmental Economics" and 'Environmental Ethics and Philosophy", "Environmental Sociology" and "Sustainable development" are suggested to add to the curriculum of the all environmental engineering program as elective courses in Iran. Environmental Engineering education in Iran is at the beginning of way and there are a lot of obstacles for promoting these fields of study. The main obstacles are 1) The budget limitation for establishment of environmental Engineering programs 2) Lack of academic staff 3) Lack of professional jobs for environmental engineers 4) Lack of long- term planning for environmental engineering program in Iran. 5) Lack of International collaboration 6) Difficulties in official procedure of establishment of new fields and 7) Lack of professional organization to audit and evaluate the environmental engineering programs.

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