

# Engineering General Education Program at CYCU

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**Abstract:** In 1990, the Engineering General Education (EGE) Program was initiated in the College of Engineering (COE), Chung Yuan Christian University (CYCU). The course on Engineering Ethics was the first course offered by the COE, followed by several other general education (GE) oriented courses.

The overall GE Program at CYCU is monitored jointly by the Center for GE, College of Humanities and Education, and the Division of Students' Academic Affairs, with the former taking the lead. The Program usually develops, monitors, and approves all GE courses based on the principles of the Creator, the entire creation, human beings, and the individual. The COE is responsible for developing and monitoring the GE courses of the engineering nature to ensure that the students of the engineering discipline in particular and the students of the other disciplines in general get the opportunities to be exposed to the EGE courses and knowledge.

This paper discusses the formation process for the courses in the EGE Program, the content of each course in the Program, the method of teaching implemented, the accomplishment achieved, the problems encountered, and the challenges ahead.

**Keywords:** Engineering General Education, CYCU

## 1. Introduction

An engineer is expected to possess a variety of professional training in the four areas of importance as suggested by [1]:

- I. Abilities: (1) Communication and integration, (2) Planning and organization, (3) Learning and Adaptation, (4) Innovation and breakthrough, and (5) Discovering and solving problems
- II. Mind-setting: (1) Loyalty to employer, (2) Fair share contribution to work, (3) Teamwork, (4) System Concept, (5) Quality concept, and (6) Cost concept
- III. Awareness: (1) Professional ethics, (2) Concept of environmental protection, (3) Lawfulness, and (4) Pay special attention to the intellectual property rights
- IV. Perspectives: (1) Societal, (2) Historical, (3) Futuristic, (4) International, and (5) God versus human beings

In addition, as proposed in [1], the engineering education in universities should provide students with capabilities and training in four areas: (1) Fundamental capabilities, (2) Professional techniques, (3) General training, and (4) Professional training.

As a result of the professional requirements, it is appropriate to list the engineering students learning outcomes proposed by McGourty et al. [2]: (1) Analytical skills, (2) Communication, (3) Creative problem solving, (4) Project management, (5) Research skills, (6) Self learning, (7) System thinking, (8) Teamwork, and (9) Technical competence

These are the items to be examined to know how effective engineering students have learned and developed the various technical and behavioral skills. While many of these skills could be learned and trained in various technical courses, many can be specifically emphasized in engineering general education (EGE) oriented courses.

The engineering education offered by universities traditionally focused on the learning and training of specific professional knowledge and techniques, with little emphasis on the training of engineering professionalism. Educators at Chung Yuan Christian University (CYCU) have been fully aware of the importance of the students' learning of the general education (GE) related knowledge. As a result, they have passed a resolution that each student is required to take 34 semester credits of GE oriented courses to graduate. This comprises about 24% of their entire credits for graduation for the engineering bachelor of science (BS) degrees.

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[3]. In addition, the Center for GE is responsible for holding all kinds of GE activities, academic symposia, and enhancing the curriculum of common courses to provide general knowledge for students of all disciplines [4]. The COE is responsible for developing and monitoring the GE courses of the engineering nature to ensure that the students of the engineering discipline in particular and the students of the other disciplines in general get the opportunities to be exposed to the EGE courses and knowledge. The EGE Program is also intended to help make the overall GE Program at CYCU more holistic and better fitted for the engineering students in particular.

Besides the overall GE oriented course requirements, the Committee on Courses' Related Issues of the College of Engineering (COE) has passed the resolution that, beginning in the fall semester of 2000, each entering freshman engineering student is required to take at least one EGE oriented course (usually 2 semester credits for each course) to graduate. This is about 6% of the overall GE course requirements. The purpose of this requirement is two folds: (1) to ensure that each engineering student has the opportunity to take at least one EGE oriented courses and (2) to ensure that the cost effectiveness of offering each EGE course is achievable. Due to the more strict requirements for the EGE courses than most of the common GE courses, the fact that the students tend to stay away from taking the EGE courses that makes the registration rates of these courses relatively low.

This paper discusses the formation process for the courses in the EGE Program, the content of each course in the Program, the method of teaching implemented, the accomplishment achieved, the problems encountered, and the challenges ahead.

## **2. EGE Oriented Courses Offered**

There are eight EGE oriented courses available - some are offered each semester while others are offered once a year. The content of each course usually is determined by a committee formed by the instructors organizing and supervising the course. At the end of the semester, the students' evaluation of the courses will be taken and reviewed so that revision can be made in the following semester or in the next year. The content and the execution of each EGE course are listed and discussed as follows:

- I. Engineering Ethics: Introduction to Engineering Ethics, Ethics and Professional Ethics, Engineers' Duty and Professionalism, Engineering Codes of Ethics, Ethical Choices and Case Study (3 sessions – methodology, debates, and presentations of case studies), Work Ethics, Labor Law and Ethics, Biotech and Ethics, Job Safety, Environmental Protection and Ethics, Intellectual Property Rights and Ethics, Green Engineering and Environmental Ethics, Ethics as Seen from a Business Manager. The course is offered every semester by a group of 12 ~ 15 persons. More discussions on the Engineering Ethics related issues can be found in [5].
- II. Introduction to Engineering: Course Introduction, What is Engineering? Civil Engineering and Modern Construction, The Development and the Future of Industrial Engineering, Introduction to Mechanical Engineering, Bio-Medical Engineering and Medical Instruments, Introduction to Chemical Engineering, Introduction to Electronic Engineering, Introduction to Information and Computer Engineering, Introduction to Electrical Engineering, Encountering the Challenge of Engineering Profession. The course is offered once a year by the department chairs and the dean of COE.
- III. Engineering Professionalism: Course Introduction, Total Quality Management, Management and Leadership, Engineering and Law, Career Planning of Engineers, Introduction to Creative Problem Solving, Technical Communication, Knowing Yourself and Teamwork, Strategy of Investment, Engineering and Marketing, Review of the Course. The course is offered once a year by a group of 9 ~ 10 instructors.
- IV. Creative Problem Solving (CPS): Introduction to CPS, Problem Solving Procedure and Methodology, Brain Power and Thinking Patterns, Creative Thinking, Holistic Communication, Teamwork and Team Operation, Searching and Defining Problems, Formation of Ideas, Evaluation of Alternatives and Critical Thinking, Implementation of Alternatives, Pugh's Methodology, Presentations of Term Projects (2 sessions). The course is offered every semester and each course is taught by 1~2 instructors. There are four sessions offered each semester; each session accommodates up to 40 students.
- V. Total Quality Management (TQM): Course Introduction, TQM and I, Problem Resolution, Data Analysis and Method of Quality Control, Development of Quality Mechanism, Teamwork Established Via Manpower Management, Reliability, Quality of Service, International System Standard - ISO, Quality Economy, Quality Engineering, Quality Management for the High Tech Industry. The course is offered each semester by a group of 12 ~ 14 individuals.
- VI. Technical Presentation and Report Writing: Course Introduction, Resume Writing and Job

Interviewing , Report Writing, Oral Presentation, Communication by Meetings, Technical Instruction Writing, Proposal Writing, Official Memo Writing, Introduction to Technical English. This course is offered once every semester by a group of 3 ~ 4 instructors.

VII. Introduction to Future Information Technology: Future Technologies of the World, Configuration Interface, Introduction of the Law Problems in Information Technology, Human-Machine Interface in the Future World, Electronic Industry, The Present and Future of the Semiconductor Industry, Intelligent Agents, Virtual Reality, Technological Management of Information, Management of Internet Sites, The Present Status of Electronic Commerce, The Present Core Technology and Development of Mobile Communication, Harmony between Technology and Humanity. The course is offered once a year by a group of 12 ~ 14 instructors.

VIII. Technical English: Course Introduction, Brief Review of English Grammar, Mechanics and Punctuation, Sentence Patterns, English Letter Writing, English Resume and Cover Letter Writing, Introduction of Oral Presentation Using English. The course is offered once a year by an instructor.

### **3. EGE Evaluation**

The courses listed above have been offered from 5 to 10 years. So far, half of them have bound class notes; the other half have handouts from the instructors. Collecting, editing, and binding of individual handout materials into bound class notes are needed so that students will have the class materials in the beginning of the class sessions. This will help them preview and review the class materials.

Recruiting more engineering teachers to be involved in the EGE Program is a challenge to the overall success of the Program. These newly recruited teachers can (1) get the required training, (2) share the teaching loading, (3) apply the method learned and developed in the EGE course to the other courses. This aspect of the work is especially important, since beginning in the fall of 2000, all entering freshman students are required to take at least one EGE course to graduate. This will generate substantial demands for new sessions of the EGE courses to accommodate the high demand resulting from this requirement.

It is highly recommended that each session of the EGE course be evaluated by the students using the short review sheets. The sheets have three questions: (1) What have the students learned in the session? (2) What specific questions the students have about the session? (3) What are the constructive suggestions? Usually these questions can be finished in 3 ~ 5 minutes. Besides a more detailed evaluation of the entire course done at the end of each semester, the response obtained from week-to-week reviews of the course by the students will provide instant feedback to the course instructors and actions, if necessary, can be taken to revise the presentation and content of the course.

Regular or irregular meetings among the course instructors, if the course is taught jointly by a number of instructors, to discuss the course related matters have proven to be valuable in improving the course. Usually noon-time or early evening brown-bag meetings, with the food paid for by the COE, have shown to be effective and acceptable to the teachers participated.

In delivering the course content, it has been found that presentations of case studies of the matters related to the course are welcome by most students. In addition, teacher-students' interactions during the course delivery have proven to be effective in enhancing the interest of the students taking the courses.

Finally, if the department chairs and the dean of the COE have shown high interests in the development of the EGE courses, the morale of those participated in the EGE teaching will be brought up tremendously. This is especially true, if some of them can actually join the teaching teams.

### **4. Conclusions**

The development of the EGE related courses has encountered many challenges over the past ten years. These courses were designed to beef up professionalism of the students in the COE. In addition, these courses have been supplementary to the university's overall GE Program to provide the engineering students with the learning and training of the technical and behavioral skills of particular importance to their future career success.

To carry out an effective EGE Program, the following items have found to be essential:

1. to recruit more engineering teachers to the Program,
2. to review regularly each course's content and the way it is presented,
3. to develop the bound class notes, or the textbooks if possible, for each course, and
4. to have support from the department chairs and the dean of COE.

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