

Grand Challenge Scholars Program

Application to the NAE Grand Challenges Scholars Program

By

Chung Yuan Christian University

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1. Chung Yuan's educational mission, vision and objectives

Founded in 1955 in Taoyuan (Taiwan), Chung Yuan Christian University (CYCU) has emerged as one of the best private Universities of Taiwan with a strong focus on education. It is actually ranked among the top 15 of all universities in Taiwan. CYCU is now composed of 7 colleges and 29 departments all nurturing innovation, development and ingenuity of students. Since its establishment as a science and engineering college, CYCU has enrolled students in a wide range of disciplines in science, engineering, business, design, electrical engineering and computer science, humanities and education, and law. The current student body is over 16,000 students located on a campus in the northern part of Taiwan, with the convenience of urban transportations, shops, restaurants, and night markets.

CYCU has been ranked as the integrated and most prestigious institution of higher education among private universities in Taiwan by the Ministry of Education, since 1995. Thus, with this responsibility, CYCU devotes to upgrading the level of higher education in Taiwan. As a leading private university, CYCU intends to raise its reputation in the world and help young talents promote their abilities worldwide. CYCU is strongly focusing on students' education to ensure that young graduates can pursue their dream and excel in their career. For example, CYCU Office of Career Development joined the 2018 national competition for excellent career counseling under the college and university division and stood out from all the participating schools, winning the 2018 College and University Career Counseling Golden Award!

With a vision for the future, "Caring," "Integrity," "Synergy," "Innovation," "High-Tech," and "Internationalization" are the competitive advantages of the University to continue building a

global campus and offering the most valuable programs for domestic and international students who would like to broaden their horizons and to immerse their experience of the Asian Culture.

Inspired by the National Academy of Engineering's Grand Challenges for Engineering, the Grand Challenges Scholars Program (GCSP) reflects the rapidly evolving and changing nature of engineering education. The GCSP calls for developing five critical competencies, that is, talent, multidisciplinary, entrepreneurship, multicultural and social consciousness. As stated above, CYCU's long-term vision of caring, integration, innovation, high tech, and internationalization are in line with the five critical competencies stressed by the GCSP which was promulgated by the NAE Grand Challenges for Engineering. As a result, people at the College of Engineering and College of EE&CS are actively involved in the preparation of a proposal to incorporate the five critical competencies of GCSP into many existing CYCU's programs stressing our vision of caring, integrity, synergy, high-tech, and internationalization to cultivate engineering students participating in and finishing up GCSP-CYCU to become competitive, caring, integrity, synergic, innovative, multidisciplinary, multicultural, and entrepreneurship in this highly competitive and internationalized world.

2. Program in CYCU

Talent, **Multidisciplinary**, **Entrepreneurship**, **Multicultural** and **Social Consciousness** competencies will be developed through the numerous courses and activities that CYCU offers to meet these five critical criteria defined in the frame of the GCSP program. In order to build their GCSP portfolio at CYCU, student should pass 15 credits, 3 credits associated to each of the major competency, as well as they should provide a final report and give a final 30 min-presentation highlighting their achievement in each of the 5 competencies. It will be a 20p-report written in English in which candidates will describe each course and activity they took part in during the project. They will need to put the emphasis on (i) how these activities fit in the requirements of the program and on (ii) the corresponding goal, among the 14 goals required to deliver the vision of the GCSP, they believe to have contributed to achieve. Therefore, the report should clearly highlight the main GC theme the candidate selected and its connectivity with the activities taken. Besides, 3 competencies at most can be demonstrated through coursework (and one A at least should be scored). It means that at least 2 competencies will have to be demonstrated through students completing some research project or joining any of the activities described in the next sections. Below are further details regarding the courses.

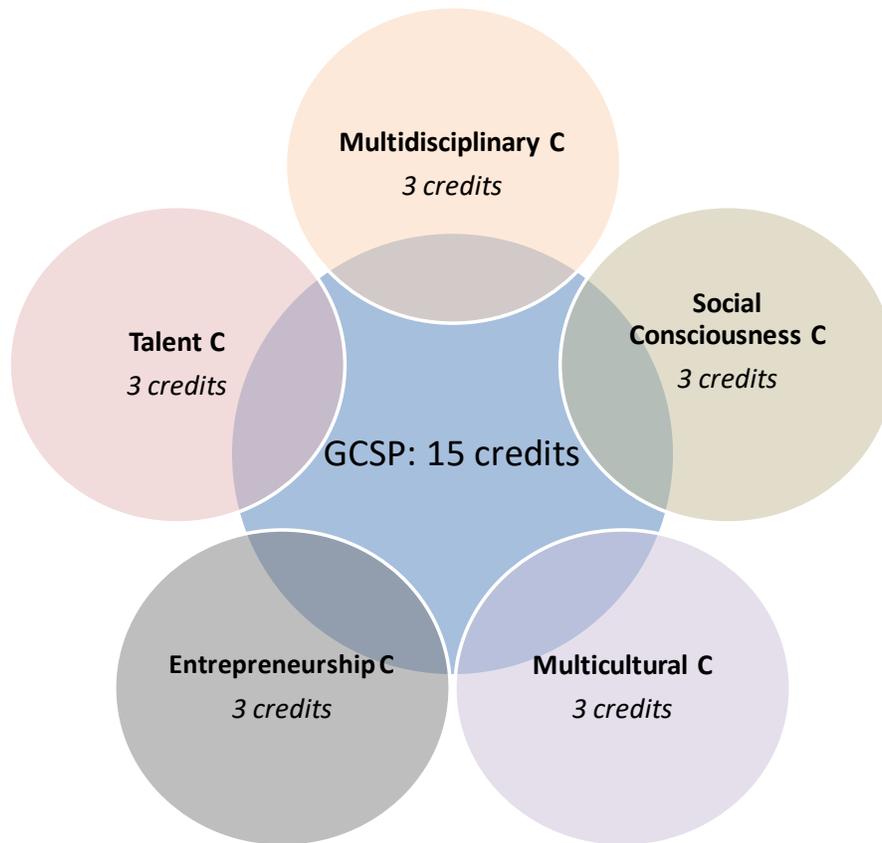


Figure 1. Overview of the requirements for the GCSP program at CYCU

2.1 Courses and activities fostering the **Talent** competency of students.

Students should both pass major courses offered by their department and participate in an activity to demonstrate their talent competency.

Regarding the courses, these are all the **representative** major courses offered by each department. For example, the department of chemical engineering offers a number of courses oriented towards the utilization of the physical and chemical sciences in the economical design and operation of industrial plants. One such course is “Process Design” which focusses on the choice and sequencing of units for the intended transformation of materials. It is considered by many to

be the summit of chemical engineering as it brings together most of the major components of the field. To excel in Process design, students must have an overview of all major unit operations of chemical engineering. Another typical example of course in “Process Control” which focusses on adapting the process based on process monitoring results. Talented chemical engineers are able to quickly identify actions to take in order to keep processes and unit operations in-control.

Choices of the courses for the **Talent competency** of the applicant should be based on the representative nature of the course with respect to the major. Therefore, each department should draw a list of the major courses they offer potentially falling in that category. It is also advised that the applicant should be ranked in the top 20% of the class.

Regarding the activity, students will have to participate in a research project or work in a research lab. Once they join this program, their mentor will define a research project that they will work on. They will also be leaded by a graduate student (MSc or PhD student depending on the group the candidate will belong to). The results of the research project will be presented in the report, that will also need to detail the core question the candidate intended to address and the experimental procedure followed to answer the question.

2.2 Courses and activities promoting Innovation and Entrepreneurship

Whether it is through courses, summer internships in companies or lab internships, there are multiple ways in which students can develop their Innovation and Entrepreneurship competency at CYCU. Like for the other competencies, students enrolled in the GCSP will have to earn 3 credits. Below are further noteworthy examples.

- Some **key courses** are offered in the college of business and are listed as follows:
 - *Creative Problem Solving*
 - *The Study of Creative Life Industries*
 - *Creative Thinking about Sustainability*
 - *Entrepreneurship Practices*
 - *Innovation and Start-Ups Management*
 - *Entrepreneurship*
 - *Design-driven Entrepreneurship and Business Model*

As a first example, the course entitled “Entrepreneurship” taught by Prof. Yi-Rong Lu was designed for students to learn about the characteristics of an entrepreneur and the various elements essential to developing and leading a successful entrepreneurial enterprise. In this course, students learn the attributes a successful entrepreneur must have, beginning with how to develop a business plan. It also covers all aspects of product/service marketing and development, but also provides essential information on how to develop an effective accounting system.

Another key course that students could take to acquire the related competency is the course entitled “*Design-driven Entrepreneurship and Business Model*”, taught by Prof. Jesheng Huang, and focusing on business models, that is the rationale of how an organization creates, delivers, and captures value. The objective of the course is to provide a comprehensive and up-to-date treatment of the subjects of design-driven innovation, design-driven entrepreneurship and its strategic business mode, especially in the digital era. Students learn how to systematically understand, design, and implement a design-driven business model. Along the way, they are taught to understand at a much deeper level notions of customers, distribution channels, partners, revenue streams, costs, and core value.

A third example of course related to the Innovation and Entrepreneurship competency is the course on "Innovation and Start-Ups Management". This course, taught by Prof. Pi-Tao Kuo aims at improving the success rate of entrepreneurship but also to inspire, train, and coach the next generation of entrepreneurs. The entrepreneurship management course not only teaches "how to open a company" or "how to be a boss" but also stresses on the essence of entrepreneurship, that is, innovation. Therefore, the emphasis is put on creativity and innovation, on how to find ideas from customer needs and how to answer these needs from technical knowledge and engineering practices.

For further information regarding the multiple courses related to the Innovation and Entrepreneurship competency, one is invited to refer to the following link:

https://itouch.cycu.edu.tw/active_system/CourseQuerySystem/eng/

- Besides, in the end of their Bachelor degree, students have the possibility to join companies or institutes for **Summer Internships**. As a recognized private educational institution in Taiwan, CYCU's brightest students are often given the possibility to work with companies/research institutes with a variety of recognized technology expertise (semi-conductor industries (Taiwan Semiconductor Manufacturing Company, the world's largest independent semiconductor foundry), chemical companies (LCY corp.), institutes (Industrial Technology Research Institute), etc.). These internships stimulate their curiosity and definitely cultivate their entrepreneurial mindset. At the end of the summer internship, a written report will have to be presented by the candidate, and an oral presentation will have to be delivered to faculties mentoring candidates to the GCSP, in order for the student to acquire the Innovation and Entrepreneurship competency.

- Students in their *Junior* and *Senior* year are also given the possibility to join a lab and **conduct research projects** under the guidance of a professor. This is not only an initiation to the research world, but also a great opportunity for young students to start making decisions, to demonstrate their adaptability and flexibility, their ability to think and plan ahead, as well as their organizational skills. During these two years, the focus is also laid on presentation skills whereby students learn to present and convince an audience. Presentations, in lab group meetings, in symposium and workshops organized by the department, or in conferences at the national/international level strengthen their entrepreneurship mindset. Meeting people from diverse horizons not only grows their network, but also allows them to have a broader picture of the lacks and needs of world around them. The results of the research project will be presented in a report, that will also need to detail the core question the candidate intended to address and the experimental procedure followed to answer the question. A panel of faculties mentoring GCSP candidates will be in charge of evaluating the report. Notice that if candidates decide to validate the Talent competency using the research project, then they will need to choose a different route to acquire the Innovation and Entrepreneurship competency (using for example a course on Entrepreneurship or Summer Internship in a company or institute different from the lab where they conducted their research project).

2.3 Courses and activities developing **Multicultural** competency

- CYCU professors offer a number of courses aiming at developing the knowledge of other cultures. Major objectives of these courses are to think diversely, to develop a senses of

responsibility and ethics, to improve communication and cooperation at an international level, and to engage socially with others. Some typical examples of such courses are:

- *Intercultural Communication*
- *Introduction to Global Culture;*
- *Introduction to Multiculture*
- *Exploring Southeast Asia's Society and Culture*
- *Ecology and Culture (II)*
- *The International Industrial/Academic Leadership Experience Course*
- *The International Innovation & Entrepreneur Leadership Experience Program*

Besides some of these courses are the cross-road between competencies. For instance, the course on *International Innovation & Entrepreneur Leadership Experience Program* stresses on engaging Entrepreneurship abroad.

- Besides, CYCU has developed a network of sisters Universities worldwide. CYCU actually has 350 international sister universities. Among them, University of Southern California, University of California in Los Angeles, NangYang Technological University, University of Tokyo are the newest universities having signed MOU with CYCU, with the goal to academically collaborate in exchanges of faculty and student, conduct joint research, hold joint lectures and symposia, or exchange academic information and materials. Candidates to the GCSP will be strongly encouraged to take one semester abroad to learn cutting edge technologies but also to widen their horizon and views of global culture. Scholarship will be attributed to the students from the GCSP program.

There is no limitation regarding the programs students applying for exchange can take. In other words, GCSP candidates will be free to choose the courses they want to take to

enhance their knowledge of science and engineering. Generally, and from our past experience, exchange students coming from CYCU generally focus their attention on major courses during their semester abroad. If they have extra time, they also like to participate in other minor courses or activities offered by the sister University. In the environment of study abroad, exchange students meet "cultural differences" that make them adjust their mindset. Besides, they have to fit in a new environment where a different language is spoken. Clearly, studying abroad is a great opportunity to cultivate the multicultural competency and GCSP candidates will be strongly encouraged to do it.

2.4 Courses and activities developing Social consciousness competency

- CYCU has been awarded for five consecutive years by the World University Ranking as number one in Taiwan Private Comprehensive University. From their Junior year, students develop awareness of important social issues regarding diverse topics including psychological/physical health, stress and emotion, environment, the place of Taiwan in the world.

Examples of courses awaking social consciousness in students are:

- *Environment and Happy Life*
- *The Green Living and Sustainable Environment*
- *Disaster Prevention Technology and Life*
- *Ecological Engineering and Life*
- *Seminar on Management of Life*
- *Stress Management*
- *Emotion Management*
- *Positive Psychology*

- *Contemporary International Politics*
 - *The Politics and Society of Southeast Asia*
 - *Taiwan and The World*
- CYCU students are also strongly encouraged to join clubs. There are actually 126 clubs, and some of them are exclusively focusing on the problems faced in our society and community. For examples clubs such as “law service”, “good-neighbor”, “emergency medical care” or “animal welfare” strongly develop the Social consciousness competency. Besides students and alumni associations strengthen social relationships.
 - In CYCU, we do have a **Service Learning Office** that coordinates service learning activities (<http://sl.cycu.edu.tw/wSite/mp?mp=00402>). This office aims at encouraging students to get involved in projects that engage them in understanding “service to others”.
For instance, an interdisciplinary group of CYCU female students was formed to concern and speak for girls in Africa. These CYCU students filmed videos to speak for the girls in Africa.. CYCU teachers and students are strongly concerned about Africa, but also about new immigrants (coming in particular from South East Asia) and the elderly people. They regularly call on the public to raise their concerns about integration of immigrants, but also to improve gender equality in the society, ameliorate public welfare, and make life more meaningful and fair across various ethnic groups and borders.
Some of the service learning projects/activities also attract media attention. For example, CYCU also organized a “You Must Care” press conference in Taipei NGO House to call on everyone to care for the various ethnic groups across regions and borders. At the conference, the students raised the boards stating “Care Teachers”, “Care Students”,

“Care Public Welfare” and “Care Good Virtues”. Other groups participated in the cloth pad promotion plan, “Love Binti”, in Africa. The students developed their creative ideas and filmed videos, inviting girls from both Taiwan and Africa to answer questions.

The GCSP candidate will be strongly encouraged to be involved in one of the service learning projects/activities that CYCU offers.

2.5 Courses and activities nurturing **Multidisciplinary** competency

- In order to build their GCSP portfolio and provide evidence of their multidisciplinary competency, students will have the possibility to either elect courses complementing their academic major or participate in school activities (eg.: summer camp presented below). CYCU offers multiple school curricula in its 29 department. Choice of minor courses will have to be approved by the student’s mentor.

- CYCU organizes a summer camp combining The International Industrial/Academic Leadership Experience (II/ALE) and The International Innovation & Entrepreneur Leadership Experience (II/ELE) ([Figure 2](#)). This camp lasts approximately 3 weeks in July at aims at developing cross-functional activities between students from Taiwan and abroad. Below is a brief description of the camp:

- *Students earn 3 credits provided successful completion of team research project;*
- *English is the exclusive language as CYCU students work together with foreign students in multicultural teams;*
- *During the camp, 6-8 high-tech lectures in multidisciplinary fields including Engineering, Economy, Leadership, Human-caring are delivered to students;*

- Multicultural trips are organized during the weekends to introduce Taiwan and Taiwan's culture;
- Field trips are organized to 6/9 factories or plants (II/ALE) or companies (II/ELE);
- Hands-on practice though engineering/entrepreneurship topics help students nurturing their innovation mindset;
- A competition and award ceremony is organized at the end of the camp.

2018 Industrial Academic Leadership Experience (IIALE) Program
產業及學術國際領袖體驗講座

上課期間 ▶ 107.7.2 ~ 107.7.20

學分數 ▶ 選修3學分 (人工加選)

課程特色 ▶ University of Wisconsin- Milwaukee, (威斯康辛-密爾瓦基大學)
 Iowa State Univ. (愛荷華州立大學)
 University of North Dakota(北達科他州大學)
 San José State University(聖荷西州立大學)
 Tokyo Denki University (東京電機大學)
 Mapua Institute of Technology (瑪布阿科學技術學院, 菲律賓大學)
 BINUS University(印尼, BINUS大學)
 Mongolian University of Science and Technology(蒙古科技大學)
 South East Univ. (大陸東南大學)
 Beijing Institute of Technology (大陸北京理工大學)

參加對象 ▶ 本校工學院/電資學院
 各系準研究生、大學部
 高年級生及研究所學生
 (107學年度本校在學生)

報名方式(3個步驟都完成才算報名成功喔!!)
 即日起至107年5月25日(五)止

Step 1 至i-touch—活動公告報名—移至7月11日—填寫報名或掃碼報名

Step 2 至維澈樓一樓出納組繳費(編號: 122028產業營, 並報上學號)

Step 3 繳費收據拍照傳送e-mail至chiaju@cycu.edu.tw
 郭家茹助理 洽詢電話 265-4002

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Figure 2. Flyer of the 2018 Industrial Academic Leadership Experience (IIALE) Program organized in CYCU.

3. Recruitment of Candidates to the GCSP Program

3.1 Offices involved in students recruitment and advertisement of the program

Once granted, each admission office across CYCU will be made aware of the GCSP program to facilitate students' awareness of the program, and to draw a list of potential candidates. Note that candidates will be selected from the 9 engineering departments during the first term of the program. We expect to advertise the program and the 14 themes in the University from early August 2019 using the school website but also each department's social page. Besides, posters will be printed and displayed in each engineering department's office, as well as promotional flyers will be given to prospective and admitted students. We expect to let student enter the program as soon as their freshman year, but we will also open it to sophomore. Therefore, there will be continuous on-campus advertisement coming in the form of advertisements on campus screens, posters and presentations given in the beginning of the fall and spring semesters by the director or committee members. CYCU also organizes career fairs on the campus, where the program will be strongly advertised.

3.2 Students application and selection

To apply, students from one of the 9 engineering departments at CYCU should be in their freshman or sophomore year and should have a minimum GPA of 2.8 (or with academic results standing at top 20% in their corresponding department). We expect 20-30 students to enter the program each year. Students interested will have to provide:

- An application form including basic personal information;

- A resume;
- A 2-page proposal which will include their vision of the GCSP program through their course selection and which should mention a selected GC theme among the 14 possibilities;
- Transcripts from their past Academic year

Applications will be reviewed by a committee composed of the chairmen of each department participating to the project and of prospective faculty mentors, and a selection made during the fall semester. Each selected candidate will be assigned a mentor (faculty) to guide them throughout their degree and meet the GCSP requirements.

The best GCSP candidates will be given the chance to present their project at the annual Global Grand Challenges Summit through travel support awards.

3.3 Students advising

As above-mentioned, each student will be guided by a faculty mentor. Their duty will be to ensure that the selected student can complete the program by the end of their degree. They will have to schedule regular meetings with their advisee (possibly twice a month) to help them navigate through the program. They will also have to report to the committee at least once a semester in order to assess the progress of their advisee. If some unexpected difficulty arises with one student, their mentor will have to notify the director of the program, who will then call a meeting with the committee members to discuss the issue.

3.4 Students recognition

Upon graduation, NAE certificates will be awarded by the Dean at the college of Engineering, a medallion at graduation will be given to each student, and a recognition banquet organized. We also anticipate that the GC Scholar designation will be included on the transcript.

4. Program administration

A director will be appointed by the vice-president of the school. Besides, a committee will be formed, gathering the different department chairmen. It will have direct oversight of the GCSP program. The initial term will be 4 years (to let the first batch of GCSP students graduate). Then each committee member will be appointed for 2 to 3 years. The roles of the committee will be:

- To **advertise** the program in the department they belong to during department meetings;
- To **review** and assess the applications;
- To **supervise** the progress of students;
- To **engage** with students supervisors twice a year and discuss students competencies;
- To **identify** potential new curricular on-campus/off-campus activities or courses that could fall in the scope of the GCSP program by surveying up-dates regularly brought to the list of courses offered by CYCU faculties;
- To **oversee** final reports;
- To **examine, approve** and **update** new rules and policies brought to the program in the school.

The director will be responsible for mentor invitation and students recruitment. Their role will also be to overlook each candidate's progress, to organize/manage the program within the University, to ensure continuous advertisement of it, and to apply supplementary resources to keep the project running. In order to facilitate the management, she/he will dedicate at least 4h of its time/week, at fixed office hours. During this time, she/he will have to be available to meet with candidates but also their advisors, to discuss any potential difficulty. In order to be spend

enough time on the project management, she/he will have 2 credits deducted from her/his regular teaching time each semester.

The budget will be scheduled and implemented with the aim of facilitating the participation of GCSP students, GCSP candidates and faculty members to local/overseas courses, internships and academic collaborations, in order to broadly enhance and cultivate core competencies related to this GCSP program.

During the first year of GCSP, 200,000 NT\$ (about 6500 US\$) covered by our Office of International Affairs will be spent on administrative work, travel expenses to Global Grand Challenges Summit, invitation of experienced GCSP lecturer and visiting of other Engineering schools in which GCSP is well-implemented. Additional funding will be provided by the College of Engineering to enable GCSP candidates (students) to participate to exchange programs in one of CYCU's sister universities (covering at least travel expenses) in order to complete their program. We anticipate that funding from the College of Engineering will be given in priority to GCSP students.

The funding on subvention for students/candidates to GCSP program will also be supported out this budget. Applications for subvention will be submitted by students/candidates and will be reviewed by the committee in charge.

Finally, the budget may be subject to changes and adjustments during the term of the program. Each change will have to be reviewed and approved by the committee.

5. Conclusions

The GCSP program prepares our students to tackle the major challenges mainly through an aspirational vision of what engineering can/must/needs to deliver to ensure sustainability, security, health and happiness of all people.

Through our educational strategies and goals, the five major competencies of the GCSP program are represented at CYCU. Many of our curricular, co-curricular, and extra-curricular programs defining our vision for the future are clearly aligned with the GCSP's vision.

Eventually, students graduating from CYCU and having a GCSP certification will be able to (1) adjust their attitude to face new situations, (ii) add new perspectives to their original thinking, (iii) foster creative thinking and go beyond old thinking and concepts and (iv) develop new directions in their professional field, in order to adapt to the continuous changes that we are facing as a result of Human activity, and to ensure sustainability of resources and security, health and joy for all.