

Proposal to Establish a Global Challenges Scholars Program (GCSP)
at Beihang University-School of General Engineering (SGE)

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Introduction

The National Academy of Engineering (NAE) has identified 14 Grand Challenges for Engineering and called for a new engineering education paradigm – the Grand Challenges Scholars Program (GCSP) to prepare engineers to address those challenges and change the world. The GCSP has now been implemented at 51 engineering schools around the world, with over 120 more schools planning to join this initiative. Among the affiliated schools, only 4 are from Asia and Pacific region (City University of Hong Kong, National University of Singapore, Peking University and Taylor’s University, Malaysia).

The School of General Engineering (SGE) at Beihang University (BUAA) has been selected by the State Administration of Foreign Expert Affairs and the Minister of Education of China as an “International Model School of Higher Education.” The GC program is envisioned as an integral part of the curriculum of the SGE.

In accordance with the NAE GCSP “Operational Document for Proposing a GCSP at Your School”, this document describes Beihang’s vision for its GCSP, how the five GCSP components will be met, how the GC Scholars will be recruited, mentored and assessed, how the GC Director and faculty mentors will be selected, their specific roles and responsibilities, how the funding and support for GCSP will be secured, and the unique aspects of GCSP at Beihang University.

About Beihang and SGE

About Beihang

Beihang University (BUAA) was founded in 1952 with the merger of the aeronautical departments from eight top Chinese universities. Today it is one of the nation’s foremost research universities supported by China’s Project 211, Project 985 and Project 2011. Today Beihang has an enrollment of more than 29,951 students, attending 28 schools in two campuses in Beijing. Many Beihang students participate in exchange programs with partner universities across Europe, Asia, the Americas and Oceania. Among the first Chinese universities to offer postgraduate programs in English for international students, Beihang annually attracts over 1,700 foreign students from 90 countries. The Beihang faculty totals over 2,300 members whose research and teaching encompasses the sciences, engineering, economics, management, humanities, law, philosophy, education, medicine and art. A strong body of 20 accomplished professors have been inducted as members of the Chinese Academy of Sciences and/or the Chinese Academy of Engineering.

Beihang offers 189 academic programs, including 61 undergraduate programs and 128 postgraduate programs. The university has been reputed for its competitive edge in such disciplines as aeronautics and astronautics, instrument science and technology, computer science and technology, management science and engineering.

As a powerhouse of research and innovation, Beihang has earned 1,264 awards for achievements at the national or ministerial level, including three First Prizes of National Science & Technology Progress Awards and six First Prizes of National Technological Innovation Awards. Beihang also has strong links with the industrial sector, which contributes to more than 50 percent of the university's research projects.

The center of Beihang is its Xueyuan Road campus in the heart of "China's Silicon Valley" – Zhongguancun Science Park. The Park is one of the leading technology centers in the world and is growing fast into a high and new-tech industrial cluster. In addition to its Xueyuan Road Campus, the university is also located in northwest Beijing's Changping District with a newly developed campus and has comprehensive research facilities, notably the National Laboratory of Aeronautics and Astronautics (NLAA).

Beihang has also grown to be a university of global outreach, with a recently inaugurated Europe Office in Brussels and visibility in several global consortia, including Top Industrial Managers for Europe (T.I.M.E). The University maintains partnerships with 185 universities, research institutions and companies in over 30 countries. The cooperation covers faculty and student exchanges, joint workshops and publications, joint research endeavors and international educational projects. The Sino-French Engineer School (or, *Ecole Centrale de Pekin*), established by Beihang and the *Groupe des Ecoles Centrales* in 2005, has won international recognition for its excellence in international engineering education. Beihang is also home to the United Nations Regional Center for Space Science and Technology Education in Asia and the Pacific (China) established in November 2014.

About the School of General Engineering (SGE)

Established in 2017 at Beihang, SGE provides an international study environment and small-size classes to establish a solid foundation for engineering science and interdisciplinary research. The program aims to cultivate the capabilities of cooperation, the qualities of internationalization, integration, interdisciplinarity, innovation and leadership (I⁴L). It is a novel model based on "the integration of China and the West, the development of a wide range of engineering competencies: knowledge, skills, attitudes/values, including ethical behavior". In addition to Beihang local faculty, SGE faculty includes a group of international scholars and International Advisory Committee (IAC). The names and affiliations of the international scholars and advisors are in Appendices 10 and 11. The bachelor's degree program is designed as an outcomes/competency-based curriculum of four years. The program has a strong general education component, that includes three semesters of English, Introduction to

Engineering and Engineering Design, after which students choose their major (Mechanical, Electrical, Information and Electronics, or, Aeronautics and Aerospace Engineering). An optional Beihang Engineering Leadership Program is available to all undergraduate students. Students who upon completion of the bachelor's degree satisfy the requirements of the Leadership Program will obtain the **Certificate of Engineering Leadership**. It is also envisioned that students who complete the GC Scholars Program requirements (all SGE students and those from other Beihang Schools) will receive the **GC Scholars Certificate**.

Appendix 1 describes the model of the SGE curriculum and learning experiences. The following keywords describe the SGE:

- Design thinking
- Outcomes-based curriculum
- Learner-centric
- Project-based learning
- Authentic learning
- Active learning/Learn by doing
- Multidisciplinary
- Blended/Flipped learning
- Professors who know how to teach
- International faculty
- Driven by society's needs
- ABET compliant
- Developing leaders
- Partnership with industry
- World-class
- Continuous quality improvement
- Entrepreneurship

Beihang's GCSP Program Characteristics

Vision: *Provide Beihang students with an internationally recognized learning experience in addressing engineering global grand challenges*

Goals: The following table shows the alignment that exists between the goals of the Beihang- SGE and the goals of the GCSP:

| Beihang-SGE/GCSP goals | International | Interdisciplinary | Integration (industry/university; teaching/learning) | Innovation | Leadership |
|--------------------------------------|---------------|-------------------|--|------------|------------|
| Research/Creative Project Experience | | X | | X | X |
| Multidisciplinary Curriculum | | X | | | X |
| Business/Entrepreneurship | X | | X | X | X |
| Global Dimension | X | X | X | | |
| Service Learning | X | | X | | X |

GCS Program Elements:

- (a) **Selection Process:** the SGE is open to both Chinese and international students who comply with Beihang's admission standards. SGE students come from the top 20% of Beihang freshmen, with top scores in English. As seen in Appendix 1, the SGE Curriculum already incorporates programs undertaking leadership, project based learning, and internships, as well as addressing the grand challenges of engineering problems. Therefore, by design, all students in the SGE are candidates to participate in the Beihang GCSP. Students from other Beihang Schools can apply if they are approved by the dean of the students' school and also the dean of SGE, and, if they comply with the following requirements: minimum of 3.2 GPA and a minimum of B+ in English courses. Appendix 2 shows the Application form. Once the students are accepted in the program, they will form teams of 5 to pursue the certification process, with one mentor assigned to each team.

Students will be provided guidance on electives offered at Beihang where they can learn about GC topics in depth. Appendix 3 contains a list of Beihang courses that GCSP students can take as electives to learn GC theme areas in depth. The following table contains the requirements to be completed by GCSP students to receive the GC Scholar Certification upon graduation:

GCS Program Requirements

| Curricular & Learning Experience Component | Requirements |
|---|--|
| <p>Competency 1 Research/Creative Project Experience</p> | <p>2 semester Senior Capstone Team Design Project - a topic related to a GC theme chosen by the student. If the Senior Capstone Design Project is not related to a GC theme, a similar research/creative project experience (e.g., 2-semester undergraduate research experience/project) may be approved by the GCSP Steering Committee.</p> |
| <p>Competency 2 Multidisciplinary Curriculum</p> | <p>Courses:</p> <ul style="list-style-type: none"> • Year 1- GCSP Introductory workshop with the goals of becoming aware of the program, the grand challenges, form teams and start the selection process for the theme each team will address throughout the program. • Years 2-3: Take at least 1 elective course aligned with the chosen GC. Appendix 3 lists courses and learning experiences students at Beihang that students may choose. |
| <p>Business/Entrepreneurship</p> | <ul style="list-style-type: none"> • Business/entrepreneurship is covered under the Beihang SGE Engineering Leadership courses – See Appendix 4 for a description of this program <p>And one of the following in year 3 or 4:</p> <ul style="list-style-type: none"> • Securing an internship or other research/project experience that explicitly involves innovation, invention or related activity at Beihang University Science & |

| Curricular & Learning Experience Component | Requirements |
|--|---|
| | <p>Technology Park – See Appendix 5 for a description.</p> <ul style="list-style-type: none"> • Become a member of Beihang’s Entrepreneurs Club – See Appendix 5 for description. • Participate in an approved local, national or international Business Plan Competition (e.g., China Challenge Cup entrepreneurship plan Competition, International Collegiate & Design Innovation Competition, etc.) |
| Global Dimension | <p>One of the following:</p> <ul style="list-style-type: none"> • Participate in Beihang SGE Summer School with international students and native high school students. The program for the Summer school will include development of a GC Outreach Package (ppt slides, videos, brochure, etc.) that will be used to share the GC challenges to high school students in China in the following year. • Spend a one semester overseas and have a cultural experience in addition to technical courses – See Appendix 6 • Participate in an approved overseas competition (e.g., Robotics competition, mathematical modeling contest, etc.) • Participate in an international Summer School in a foreign university or at Beihang |
| Service Learning | <p>One of the following:</p> <ul style="list-style-type: none"> • Be a member of the Beihang GCSP Student Club, which would gather all students that choose to participate in the GC program (to be established) |

| Curricular & Learning Experience Component | Requirements |
|--|---|
| | <ul style="list-style-type: none"> • Participate in the GC Outreach Program to middle and high schools in Beijing and throughout China (see above). |

(b) **GCSP Themes/Topics:** The school is focusing on the following GC themes/topics, which are aligned with China’s needs and Beihang’s expertise:

Energy and Environment Grand Challenge Theme:

- (1) Make solar energy economical
- (2) Develop methods for carbon sequestration
- (3) Manage the nitrogen cycle
- (4) Provide access to clean water

Health Grand Challenge Theme:

- (1) Advance health informatics

Security Grand Challenge Theme:

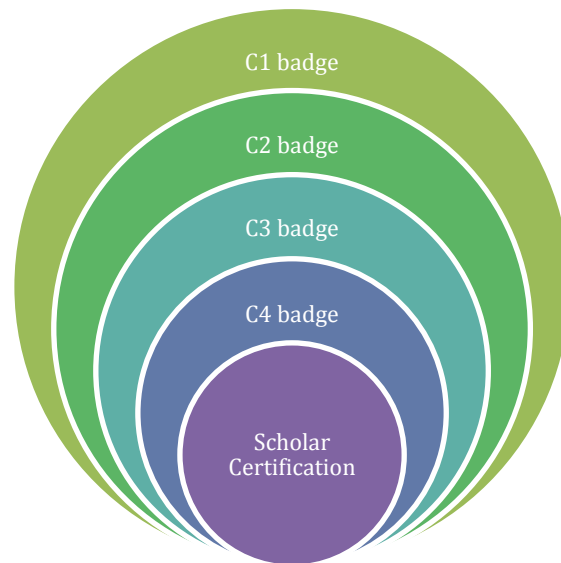
- (1) Prevent nuclear terror
- (2) Secure cyberspace
- (3) Restore urban infrastructure

Joy of Living Grand Challenge Theme:

- (1) Reverse engineer the brain
- (2) Enhance virtual reality
- (3) Advance personalized learning
- (4) Engineer the tools of scientific discovery

d) **GCSP Application/Mentoring/Evaluation:** As mentioned above, all SGE students can be automatically accepted into the GCSP program so long as they are willing to apply. Other engineering students at BUAA interested in the program can also apply to participate in the GCSP workshop to know more about this program and to get ready for the formal application at the end of their first year. Students with a GPA above 3.2 and B+ in English courses in the end of the first year are qualified to submit the application for GCSP. Each applicant will be required to submit a completed application form that will indicate their courses taken and grades received, their interests in the Grand Challenges, and which theme they would like to address. The application form is included in Appendix 2. The GC Scholars are to commit themselves to one more of the Grand Challenges and focus on those challenges throughout their program. The selection criteria for scholar applicants will be according to the demonstrated passions for one or more Grand Challenges in the application, and the overall performance of the applicants during the GCSP Steering Committee interview. A score will be given to each applicant by the GCSP committee members during the interview, and the selection will be according to the score level.

GCSP students' progress towards certification will be marked by the awarding of a "GCSP Competency badge" by the Program Director as the competencies are completed:



GC Scholars will be required to choose a mentor in the mentor list (Appendix 7) suggested by the GCSP Steering Committee when they submit the application form. The Scholars will work with their mentors to select their GC courses, research/project topic, and the appropriate activities to fulfill the requirements of the 5 components for addressing their interested GC. The mentor will also be responsible for evaluating the Scholars' research/project performance in conjunction with the Steering Committee.

GC Scholars will be comprehensively evaluated by the GCSP Steering Committee in their third and fourth years at Beihang based on their overall performance in the five major components of the program. An example of the evaluation form is attached as Appendix 8. The Scholars will be required to give an oral presentation to the GCSP Steering Committee, indicating their completion of the five components and how the Grand Challenge(s) they chose have been addressed. The GCSP Certificate will be issued to the qualified Scholars in the graduation ceremony.

e) GCSP Organization and Administration: The GCSP will be led by a Director who reports directly to the Dean of SGE. A GCSP Steering Committee will assist the Director in decision-making and to be composed of: the GCSP Director, Dean of SGE, Associate Dean of SGE, a representative of the Mentors and five faculty members representing the University Schools of Mechanical, Electronics, Aeronautics, Astronautics and Instrumentation Science & Optoelectronics Engineering. The Director will administer, oversee and assess the GCSP in conjunction with the Steering Committee. Therefore a specific, dedicated faculty member will be appointed to be fully responsible for this. The requirements for the GC Director include:

1. Excellent organization and communication skills. The various activities under the 5 components of GCSP to address 14 Grand Challenges requires extensive organization, management and communication to guarantee the program running smoothly.
2. Interdisciplinary background, so that the Director can oversee the design of the program and ensure the comprehensive coverage of the GCSP.
3. Overseas background. The Director should have oversea studying or working background, so that he/she can have an international perspective to ensure the GCSP global component.
4. Good personality. The Director should be someone easy going and dedicate to the program, to guarantee the five components of GCSP be well implemented.

Dr. Guangcun Shan will act as the GCSP Director at Beihang-SGE under the direct supervision of the Dean of Engineering (Dr. WEN), and an Associate Dean of Engineering (Dr. ZHAO), who is in charge of the Education and International Programs at SGE.

Dr. SHAN got his Ph.D. from the City University of Hong Kong, the College of Science and Engineering (CSE), which has already succeeded in joining this GCSP initiative. Dr. Shan works on Opto-electronics Engineering and Materials Sciences, has been selected into the National 1000-talent Youth Program and is in charge of several national key R&D

programs in multidisciplinary projects in China. By its very nature, Opto-electronics Engineering and Materials Sciences stand at the interdisciplinary interface with many other disciplines, and this background provides Dr. Shan a good foundation to work on the GCSP program design to ensure its comprehensive coverage. In 2012 Dr. SHAN was a visiting scholar at Columbia University in New York City; he worked at Saarland University as a visiting Professor in Germany in 2016. It is also noteworthy pointing out that this July Prof. Dr. Shan led a Beihang team of six undergraduate students to participate in the Student Business Model Competition in Student Day of Global Grand Challenges Summit 2017 in Washington DC. These overseas assignments and working expertise have prepared Dr. Shan to be the Beihang GCSP Director. He will be able to communicate effectively with the GCSP Network Director and the Directors from other universities within the network. Dr. SHAN was awarded the Outstanding Academic Performance Award (OAPA) from City University of Hong Kong and has regularly received highly rated teaching evaluations from students at Beihang. He will work full-time on the GCSP and be the key person to administer, oversee and assess the program in conjunction with the Steering Committee.

The faculty mentors (one per each team of 5 students) will come from the four Beihang Schools mentioned above, whose research fields are related to the four themes (sustainability, health, security and joy of living) addressing the 14 Grand Challenges. As part of their normal educational/service duties the mentors will receive extra financial remuneration for the GCSP role. They participate in the Scholars selection process, help to link individual GC Scholars with research opportunities within their departments or within interdisciplinary groups with whom they collaborate, and help to advise Scholars on course selection and on how to complete the five components of the GCSP program.

The Steering Committee will advise the GCSP Director on strategy and operational issues to facilitate continuous improvement, oversee the Scholars selection process, liaise with faculty and staff on GCSP matters as needed, and suggest new topics and skills to be included in the GCSP program. The proposed members of the Steering Committee are listed in Appendix 9.

Resource Plan

Beihang has already secured the resources needed to launch and maintain the GCSP through the resources received to establish the new School of General Engineering. The resources include: a donation from Beihang Student Research Training Program Fund (1.0 million RMB, \$150,000), International Collegiate Design Innovation Competition Fund (1.0

million RMB, \$150,000) and Beihang Fengru Cup Innovation Fund (3.0 million RMB, \$450,000). In addition, Beihang University has approved the financial support for the SGE Summer School mentioned above.

The financial support will be used mainly for GCSP related activities, including the costs for GCSP lectures, research, travels and other program costs. It is expected that once the GCSP is fully launched at Beihang, it will attract exceptionally strong students. SGE will offer between 5 to 10 tuition scholarships to the top Scholars based on their mid-term evaluation at the end of their second year.

Other resources will come from the cooperative entities which can provide direct support to the innovative and entrepreneurial activities under the GCSP.

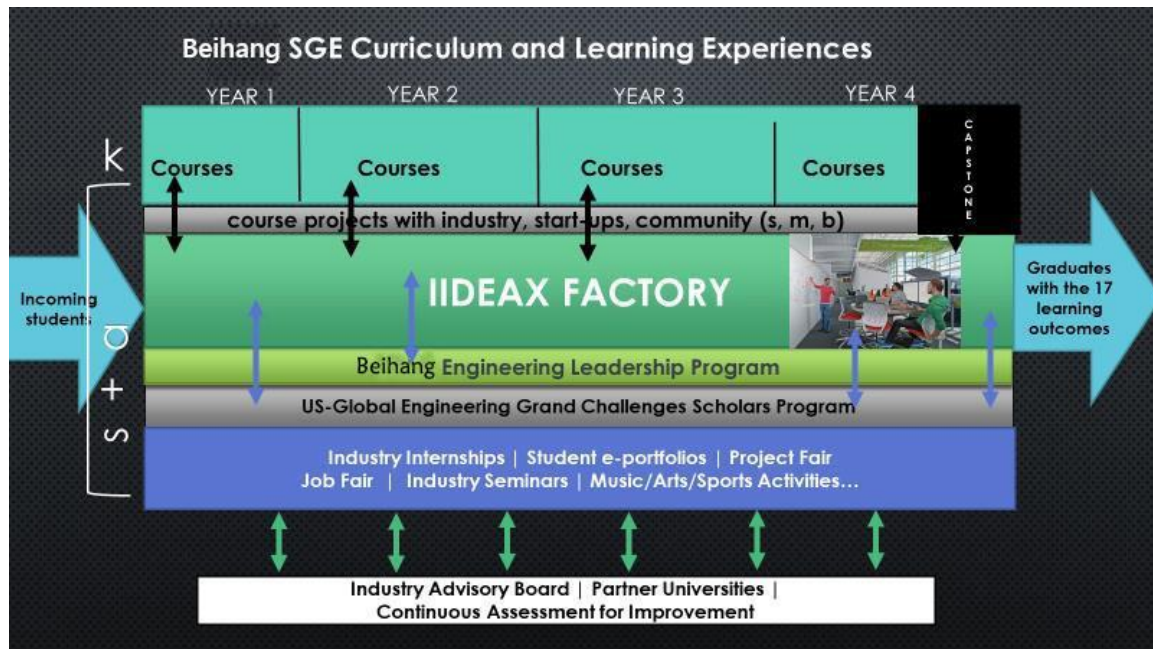
Uniqueness

The School of General Engineering at Beihang University is a unique endeavor in higher education in China. Selected by the State Administration of Foreign Expert Affairs and the Minister of Education of China as an “International Model School of Higher Education” it is the only school that has developed its curriculum and learning experiences specifically to achieve these goals. All the students of the SGE will be required to complete the GCSP requirements, thus becoming perhaps the only school in the GCSP global community to do so. This can become a model in China and around the world.

Appendix list

| No. | Title |
|-------------|--|
| Appendix 1 | Beihang SGE Curriculum and Learning Experiences Model |
| Appendix 2 | Application Form |
| Appendix 3 | List of Courses Existing at Beihang Available for GCSP Students to Take as Electives to Satisfy the Interdisciplinary Competency |
| Appendix 4 | Description of Beihang SGE Engineering Leadership courses |
| Appendix 5 | Description of Beihang's Entrepreneurs Club |
| Appendix 6 | Overseas Study and Cultural Experience |
| Appendix 7 | Members of the GCSP Mentors |
| Appendix 8 | Evaluation Form |
| Appendix 9 | Members of the GCSP Steering Committee at Beihang |
| Appendix 10 | Members of the International Advisory Committee at Beihang |
| Appendix 11 | Members of the Visiting International Faculty at Beihang |

Beihang SGE Curriculum and Learning Experiences Model



SGE Curriculum Model Description

In order to develop the seventeen learning outcomes of the School of General Engineering (SGE) graduates, the Beihang curriculum is composed of various dimensions that interact and complement each other.

Courses Sciences and engineering and general education courses as we traditionally know them. Although lectures will be the predominant teaching method, new active learning teaching/learning methods will be used, some of them being project based learning, learning in teams and oral/written communication skills required. Projects will be small, medium, and large depending on course content BUAA all will be authentic (real-life, be it industry, start-ups, community or some aspect of real life).

IIDEAX This is the central hub/space place for student learning, thinking and generating ideas. The meeting place for student teams to conduct their brainstorming, idea generation and project work, located in the 11th floor of the Engineering Building (D-1120). It will also be the place to conduct the BUAA Engineering Leadership Program classes, workshops and seminars.

Beihang Engineering Leadership Program (ELP) Among other objectives, Beihang General Engineering School aims to assure that the students they graduate will be adaptive leaders that work effectively in multidisciplinary teams..." This entails providing

students not only with strong analytical skills, but also with leadership competencies such as vision, creativity, superior communication skills, high ethical standards, resourcefulness, flexibility - among other. These will be addressed by the ELP.

US-Global Engineering Grand Challenges Scholars Program A group of talented students will be selected to participate in this worldwide program to work in teams and try to address one of the global engineering grand challenges of engineering. Upon completion of requirements, those students will be granted the title of Grand Challenges Scholar by the US National Academy of Engineering and Beihang University.

These learning activities will be complemented by industry internships, student e-portfolios, annual project fair, job fair, industry seminars and music, arts, sports activities that complement the development of a complete engineer.

Finally, feedback for the SGE will be provided by the Industry Advisory Board, collaboration with partner universities through a process of outcomes assessments focused on providing data for decision-making and continuous improvement.

The Beihang Grand Challenge Scholars Program

Please fill in the below form for your application for the Beihang Grand Challenge Scholars Program. When you have completed this application, please send the **form** as well as your application **essay** and one **recommendation letter** to gcschan@buaa.edu.cn.

Name: _____ School: _____

Phone: _____ Anticipated graduation year: _____

GPA: _____ Email: _____

Dean of SGE: _____ (signature)

If you are not an SGE student,

the Dean: _____ (signature)

Which Grand Challenges(s) most interest you? Please put a number next to the GC that you think you might be interested in. Number 1 indicates the most interested one, and 2 as the next favorite and so on.

Grouped into four larger themes, these challenges are:

Energy and Environment Grand Challenge Theme:

- (1) Make solar energy economical
- (2) Develop methods for carbon sequestration
- (3) Manage the nitrogen cycle
- (4) Provide access to clean water

Health Grand Challenge Theme:

- (1) Advance health informatics

Security Grand Challenge Theme:

- (1) Prevent nuclear terror
- (2) Secure cyberspace
- (3) Restore urban infrastructure

Joy of Living Grand Challenge Theme:

- (1) Reverse engineer the brain
- (2) Enhance virtual reality
- (3) Advance personalized learning
- (4) Engineer the tools of scientific discovery

More information about the Grand Challenge can be found through this link.

If you have identified members of the GCSP Steering Committee who you would like to serve on your subcommittee, please place a check next to their names.

Dongsheng Wen, Dean and Professor of School of General Engineering

Guangcun SHAN, Professor of School of Instrumentation Science and Opto-electronic Engineering

Shuling Hu, Professor of School of Instrumentation Science and Opto-electronic Engineering

Please help us get to know you and understand your motivations for becoming a Grand Challenge Scholar by writing an **essay** of 1500-1800 words in which you discuss why you wish to become a Grand Challenge Scholar, the theme(s) and challenge(s) you are interested in most and why, as well as what you would bring to the GCSP.

Please provide **letter of recommendation** from your academic adviser.

Beihang Courses Available for GCSP Students to Take as Electives to satisfy the interdisciplinary competency

Part 1

| COURSE PROPOSAL ---- Energy and Environment Grand Challenge Theme for GCSP | | |
|---|-----------|---|
| 1 | B2F020170 | Electromagnetic Energy and Electromagnetic Interference |
| 2 | B2G010130 | Cleanliness Production and Sustainable Development |
| 3 | B2G050140 | Fundamental Hydrodynamic |
| 4 | B2F050140 | Introduction to Energy Science |
| 5 | B2G560360 | Foundation of Entrepreneurship |
| 6 | B2G600170 | Modern International Politics |
| 7 | B2F270130 | Optoelectronic Polymer Materials and Applications |
| 8 | B2F270140 | Nanoscience and Nanotechnology in Human Life |

Part 2

| COURSE PROPOSAL ---- Health Grand Challenge Theme for GCSP | | |
|---|-----------|--|
| 1 | B2F030160 | Bionic Intelligence and UAV |
| 2 | B2F100110 | Medical Engineering Interdisciplinary Research and Technological Innovation Method |
| 3 | B2F171310 | Micro - Nano Sensing and Detection |
| 4 | B2F270140 | Nanoscience and Nanotechnology in Human Life |

Part 3

| COURSE PROPOSAL ---- Security Grand Challenge Theme for GCSP | | |
|---|-----------|---|
| 1 | B2F020110 | Introduction to Information Security |
| 2 | 50G01030 | Image Processing |
| 3 | B2G030250 | Modern Electronic Technology Experiment Based on ARM |
| 4 | B2F030150 | Motor Driving and Robots |
| 5 | B2G030270 | The Experiment of Embedded Hardware Interface Application |
| 6 | B2F030160 | Bionic Intelligence and UAV |
| 7 | B2G050160 | Introduction to Unmanned Aerial Vehicle Systems |
| 8 | B2G060130 | Computer Network Security Technology |
| 9 | B2G060170 | Operation Management and Performance Analysis of Network System |
| 10 | B2F050170 | The Safety and Reliability of Aircraft |
| 11 | B2F050320 | Exploration of Aircraft Development |
| 12 | B2F171130 | Laser Radar - from Discovery to Imaging |
| 13 | B2F171310 | Micro - Nano Sensing and Detection |
| 14 | B2F171320 | Space Photoelectric and Quantum Optics |
| 15 | B2G600170 | Modern International Politics |

Part 4

| COURSE PROPOSAL ---- Joy of Living Grand Challenge Theme for GCSP | | |
|--|-----------|---|
| 1 | B2F020170 | Electromagnetic Energy and Electromagnetic Interference |
| 2 | 50G01270 | International Commercial Law |
| 3 | B2G010130 | Cleanliness Production and Sustainable Development |
| 4 | B2F020210 | Enter the Optoelectronic Information World |
| 5 | B2G010160 | Introduction of Advanced Materials for Aeronautics and Astronautics |
| 6 | B2F020220 | Enter the Spin Electronic World |
| 7 | B2G020120 | Aeronautical Electronic Navigation |
| 8 | B2G020150 | Foundation of EDA |
| 9 | B2G020241 | The Road to International Engineers |
| 10 | B2F030120 | Frontiers of System Control |
| 11 | B2G030160 | DSP Principle and Application |
| 12 | B2F030130 | Enter the World of Robots |
| 13 | B2G030250 | Modern Electronic Technology Experiment Based on ARM |
| 14 | B2F030150 | Motor Driving and Robots |
| 15 | B2G030270 | The Experiment of Embedded Hardware Interface Application |
| 16 | B2F030160 | Bionic Intelligence and UAV |
| 17 | B2G030280 | Programmable Logic Controller's Principle and Application |
| 18 | B2G050120 | Introduction to Aircraft Design |
| 19 | B2G050140 | Syllabus for Fundamental Hydrodynamic |
| 20 | B2G050160 | Introduction to Unmanned Aerial Vehicle Systems |

| COURSE PROPOSAL ---- | | |
|--|-----------|---|
| Joy of Living Grand Challenge Theme for GCSP | | |
| 21 | B2G050170 | Innovation Experiment for Materials Mechanics |
| 22 | B2G060130 | Computer Network Security Technology |
| 23 | B2G060170 | Operation Management and Performance Analysis of Network System |
| 24 | B2G070120 | Introduction to Advanced Manufacturing Technology (In English) |
| 25 | B2G070130 | Computer Graphics |
| 26 | B2G070140 | OpenGL-based 3D Graphics Program Design |
| 27 | B2G070220 | Modern Design Methodology |
| 28 | B2G070290 | Creative Innovation and Entrepreneurship |
| 29 | B2F050140 | The Introduction to Energy Science |
| 30 | B2F050170 | The Safety and Reliability of Aircraft |
| 31 | B2F050320 | Exploration of Aircraft Development |
| 32 | B2G140110 | The Introduction to Wireless Radio Technology |
| 33 | B2G150120 | Introduction to the astronavigation |
| 34 | B2G150210 | Introduction to Deep Space Exploration |
| 35 | B2G170230 | Fundamentals of Photoelectric Technology |
| 36 | B2G170240 | Introduction to Space Remote Sensing Technology |
| 37 | B2G170310 | Amazing Laser World |
| 38 | B2G170381 | Introduction to Artificial Intelligence |
| 39 | B2G170390 | Photoelectric Detection and Imaging Technology |
| 40 | B2G190140 | Fundamentals of Computer Software Technology |
| 41 | B2F130110 | Design and Production for Intelligent Car |
| 42 | B2G200150 | Intellectual Property Law and Patent Search |
| 43 | B2F130130 | Freshman Seminar - Architecture |
| 44 | B2F150110 | Introduction to Machine Intelligence |
| 45 | B2F150130 | Intelligent Satellite |
| 46 | B2G320110 | Single-Chip Computers Principle and Applications |
| 47 | B2F150360 | Space theory (1) |
| 48 | B2F170140 | Resonant Sensor |
| 49 | B2F171130 | Laser Radar - from Discovery to Imaging |
| 50 | B2F171310 | Micro - Nano Sensing and Detection |
| 51 | B2F171320 | Space Photoelectric and Quantum Optics |
| 52 | B2F171430 | Foundation of Optoelectronic Technology |
| 53 | B2G560350 | College Students' Leadership Development and Training |
| 54 | B2G560360 | Fundamentals of Entrepreneurship |
| 55 | B2G560370 | Entrepreneurship Training (1) |
| 56 | B2G560380 | Aero-Mode Technology (primary) |
| 57 | B2G600170 | Modern International Political |
| 58 | B2F270130 | Optoelectronic Polymer Materials and Applications |
| 59 | B2F270140 | Nanoscience and Nanotechnology in Human Life |

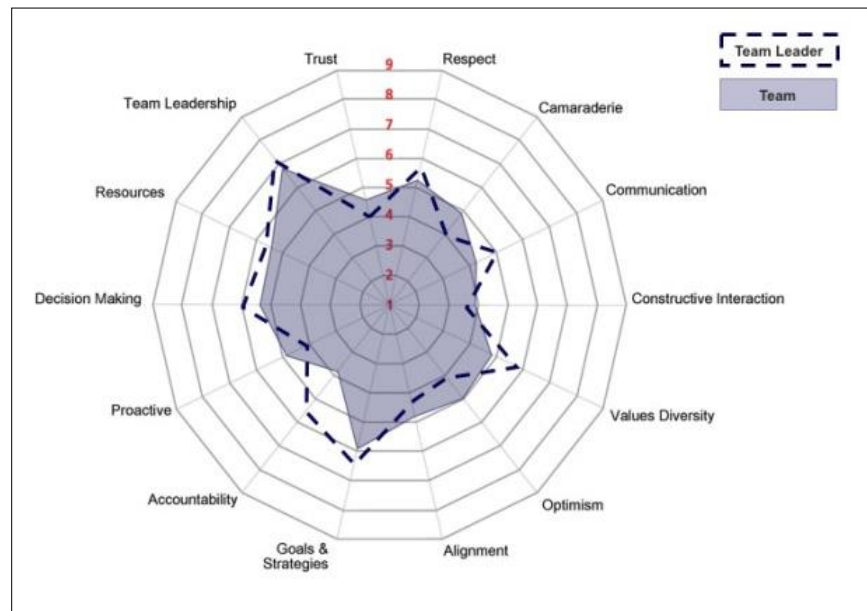
Description of Beihang SGE Engineering Leadership Program

Program Goal:

Develop leadership skills and attitudes in engineering students

Among other objectives, Beihang-SGE aims to assure that the students they graduate will be “adaptive leaders that work effectively in multidisciplinary teams...” This entails providing students not only with strong analytical skills, but also with leadership competencies such as vision, creativity, superior communication skills, high ethical standards, resourcefulness, flexibility - among others.

The *Beihang Engineering Leadership Program* addresses that challenge



Program Expected Outcomes

Students who complete the program will:

- Exhibit high moral, professional and ethical conduct
- Possess systems' thinking skills
- Demonstrate creativity, innovation and entrepreneurial skills
- Possess project management skills
- Exhibit critical and strategic thinking skills
- Exhibit complex problem-solving skills
- Possess effective communication skills
- Possess emotional intelligence skills

- Demonstrate flexibility, adaptability, and multicultural sensibility
- Demonstrate quality decision-making skills

Program Fundamental Teaching/Learning Strategies

- **Continuous assessment**
Initial, formative and summative assessments by students (self and peer assessments), faculty and projects' sponsors to promote reflection and growth
- **Engineering leadership foundations curriculum**
Courses centered on selected leadership topics
- **Supplemental leadership development and experiential learning activities**
Activities to expose students to real-life industry and stimulate them to apply lessons learned into their student projects
- **Mentoring**
Experienced individuals - including professional leaders, professors and graduate students (e.g., MBA's) - will share knowledge, experience, and advice with students
- **Cross cohort sharing /Peer-to-peer learning**
Students will share experiences as a way of enhancing the learning process and developing a shared feeling of pride and mutual loyalty (*esprit de corps*)

Leadership Competencies Guiding the Program

Top 5 Key Leadership Competencies

- Vision
- Initiative
- System Thinking
- Strategic Focus
- Resourcefulness

Other Key Leadership Competencies

- Communication
- Interpersonal Skills
- Ethical Actions and Integrity
- Decision Making
- Responsibility and Determination
- Self-Awareness and Self-Improvement
- Engage and Connect
- Negotiate and Compromise

Description of Beihang’s Entrepreneurs Club

The Alumni Entrepreneurs Club of Beihang University (BUAA) is a non-profitable networking organization founded by Beihang alumni. It is approved as a secondary organization by the Beihang Alumni Association. The mission is to gather strength and build a spiritual hub and a platform for Beihang alumni entrepreneurs, so that they can speak up and carry forward the Beihang spirit; contribute to the social, economic, and cultural development with their expertise and vision; lead the future of the society; and promote entrepreneurship among the society with the Beihang spirit of practicability.

The Alumni Entrepreneurs Club was inaugurated on May 13, 2017. Wang Zutong, president of SIM Technology was selected as the Honorary Director; Yu Jun and Xia Wei, president of Delux Technology as Directors. The Club aims to strengthen the ties among Beihang alumni and between the alumni and Beihang. It will provide a platform for the alumni to exchange entrepreneurial experience and explore ways to cooperate and develop. Through the alumni club Beihang uses its resources and expertise for the mutual benefit of the university and its alumni. Ultimately, they will together make greater contributions to economic and social development.

Overseas study and cultural experience

UPS International Development Strategy for Overseas study and cultural experience

(U: University to University, P: Professor to Professor, S: Student to Student)

U: University to University

This includes building university-wide partnerships and further establishing joint research and education bodies. Based on existing global partnerships, we are also working to develop strategic alliances, which are mutually beneficial, with like-minded leading universities.

P: Professor to Professor

This includes faculty and staff exchange, joint research, joint supervision of students, joint workshops and conferences, etc. Our faculty can invite colleagues from overseas institutions to visit Beihang for 2 weeks and upto 3 months. International visiting professors may conduct collaborative research, lecture, or jointly supervise projects at Beihang. We also encourage Beihang faculty to organize bilateral cooperative workshops, which can be held either on our campus or overseas and aim to explore collaboration in academic disciplines of mutual interest.

S: Student to Student

This includes exchange (tuition-free), double degree, summer programs, and internships. Through the links with high quality institutions across the world, our aim is to create a “Beihang Global Campus” characterized by dynamic student mobility in both directions and beneficial exchange among cultures and disciplines.

Yuanhang Plan is an overseas experience plan designed for students based on UPS International Development Strategy (U: University to University, P: Professor to Professor, S: Student to Student). The purposes of this plan is to cultivate students with solid scientific knowledge, humanistic literacy, competence in engineering practice and the

broadened understanding that results from transcultural exchange. Our plan takes advantage of quality education resources all around the world to provide Beihang students with diverse higher education geared towards the world and the future, as well as a “Global Campus”.

The Yuanhang Plan includes student exchange programs, double degree programs, joint supervision programs, summer programs, research internship, international conferences, short-term visit and exchange etc. These activities help to establish an international talent training platform by advancing engagement of undergraduates and graduates in international exchange.

Our undergraduates and graduates can obtain more project information, make online application and share experience at Yuanhang’s official website. The Yuanhang Foundation provides partial scholarships. During the Autumn semester of academic year 2018-2019, our university will carry out more than 100 high level student exchange programs/double degree programs with the principle of “Credit Exchange, Mutual Exemption of Tuition and Student Exchange” with 90 partner schools from 26 regions and countries including the United States, Canada, Germany, Holland, Denmark, Sweden, Portugal, Russia, Brazil, Japan, Israel, Malaysia and Taiwan. Of them, 54 projects are “Excellent International Exchange Projects for Undergraduates” set by China Scholarship Council. Students shortlisted in these projects are likely to win full scholarship (including round-trip international travel expense and living expenses) provided by China Scholarship Council.

Members of the GCSP Mentors

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Evaluation Form

| Five Competencies Badges | Requirements | Date of Completion for Competency Badge | Evaluation (grade from 1 to 5, deficient to excellent) |
|---|---|---|--|
| C1 - Research Experience/ Hands-on Project | ___ 2 semester Senior CAPSTONE Team Design Project - a topic related to a GC theme chosen by the student. ___ CAPSTONE Design Program ___ Similar research/creative project experience (e.g., 2-semester undergraduate research experience/project) may be approved by the GCSP Steering Committee, if the Senior Capstone Design Project is not related to a GC theme. | | |
| C2 - Interdisciplinary Curriculum | ___ Year 1 GCSP Introductory workshop with the goals of becoming aware of the program, the grand challenges, form teams and start the selection process for the theme each team will address throughout the program ___ Years 2-3 At least 1 elective course aligned with the chosen GC to fulfil the interdisciplinary exploration | | |
| C3 - Entrepreneurship | ___ Business/entrepreneurship is covered under the Beihang SGE Engineering Leadership courses ___ Securing an internship or other research/project experience that explicitly includes innovation, invention or related activity at Beihang University Science & Technology Park ___ Become a member of Beihang's Entrepreneurs Club ___ Participate in a Beihang Business Plan Competition | | |

| Five Competencies Badges | Requirements | Date of Completion for Competency Badge | Evaluation (grade from 1 to 5, deficient to excellent) |
|--------------------------------|---|---|--|
| C4 - Global Perspective | <p>__ Beihang SGE Summer School with international students and native high school students. The program for the Summer school will include development of a GC Outreach Package (ppt slides, videos, brochure, etc) that will be used to share the GC challenges to high school students in China in the following year.</p> <p>__ a one semester overseas and have a cultural experience in addition to technical courses</p> <p>__ an approved overseas competition (e.g., Robotics competition, mathematical modeling contest, etc)</p> <p>__ international Summer School in a foreign university or Beihang</p> | | |
| C5 - Service Learning | <p>member of the Beihang GCSP Student Club, which would gather all students that choose to participate in the GC program</p> <p>GC Outreach Program to middle and high schools in Beijing and throughout China (see above).</p> | | |

How have the Grand Challenges been addressed?

| 14 Grand Challenges | | Evaluations (grade from 1 to 5, worst to best) |
|---------------------|--|---|
| 1 | Advance personalized learning | |
| 2 | Make solar energy economical | |
| 3 | Enhance virtual reality | |
| 4 | Reverse-engineer the brain | |
| 5 | Engineer better medicines | |
| 6 | Advance health informatics | |
| 7 | Restore and improve urban infrastructure | |
| 8 | Secure cyberspace | |
| 9 | Provide access to clean water | |
| 10 | Provide energy from fusion | |
| 11 | Prevent nuclear terror | |
| 12 | Manage the nitrogen cycle | |
| 13 | Develop carbon sequestration methods | |
| 14 | Engineer the tools of scientific discovery | |

Members of the GCSP Steering Committee at Beihang

| GCSP Steering Committee | Name | Email |
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