



Faculty of Construction and Environment

Research Postgraduate Programme
Requirement Document 2025/26



THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學



Faculty of Construction and Environment
建設及環境學院

Opening Minds • Shaping the Future • 啟迪思維 • 成就未來

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This Document is subject to review and changes which the programmes offering Faculty/Department can decide to make from time to time. Students will be informed of the changes as and when appropriate. This Document should be read together with the Research Postgraduate Student Handbook.

Part I

General

1. Introduction

The Faculty of Construction and Environment (FCE), to achieve its mission “to meet the needs of infrastructure development and environmental conservation in Hong Kong, the Chinese mainland and beyond”, offers a broad range of international competitive academic programmes and conducts world-class high-impact interdisciplinary research in construction, environment, energy, urban hazard mitigation, urban informatics towards sustainable urban development and smart city.

FCE provides numerous programmes for studies leading to the Doctor of Philosophy (PhD) or Master of Philosophy (MPhil) degrees. Research students are nurtured to become scholars, researchers, and entrepreneurs who can ***demonstrate research and scholarship excellence, conduct independent and original research, and engage in lifelong learning.***

Our Research Postgraduate (RPg) Programmes are designed to facilitate the competence development in research methods and scholarships. Students are encourage to display sustained effort and independent original thought for high-impact interdisciplinary research. The Faculty also strives to develop entrepreneurial competencies in students by promoting the exchange of inventive ideas and entrepreneurial experiences.

MPhil and PhD students are required to satisfactorily investigate or evaluate a chosen area, to show understanding of the context and significance of the work, and to present a compelling thesis worthy of publication. Furthermore, PhD students are expected to produce evidence and arguments to support an original proposition that represents a significant contribution to knowledge.

The degree of PhD or MPhil shall be awarded to a student who, on completion of an approved programme and fulfilling the coursework requirements for graduation, presents a thesis embodying the results of his/her research and satisfies the examiners in an oral examination (and other examinations if required) in matters relevant to the subject of the thesis.

2. Educational Aims and Institutional Learning Outcomes

Built on the strength of its research in sustainable urban development, the Faculty's diversified postgraduate programmes aim to make the world a better place by engaging in multidisciplinary research. On completion of their postgraduate degrees, students are expected to be able to demonstrate research and scholarship excellence, originality, and lifelong learning capability.

2.1 Socially responsible leaders with a strong sense of national pride and a global outlook

MPhil graduates of PolyU should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.

PhD graduates of PolyU should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.

2.2 Future-ready professionals who possess technical acumen

MPhil graduates of PolyU should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues. They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.

PhD graduates of PolyU should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues. They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.

2.3 Critical thinkers and creative problem solvers

MPhil graduates of PolyU should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions. They should also be able to formulate individual research tasks and develop well-reasoned solutions.

PhD graduates of PolyU should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions. They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.

2.4 Effective communicators and collaborators

MPhil graduates of PolyU should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.

PhD graduates of PolyU should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/professional endeavours.

2.5 Adaptable and resilient lifelong learners

MPhil graduates of PolyU should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.

PhD graduates of PolyU should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.

3. **Mode of Study and Duration**

3.1 **Academic Year**

There are two teaching semesters, each lasting for 13 weeks, and a 7-week summer term. The teaching of Semester One starts in late August or early September. The teaching of Semester Two commences in mid-January and that of Summer Term runs from May to July.

3.2 **Mode of Study and Duration**

The following table shows the normal and maximum periods of study for various research degree programmes. Students enrolled for Dual PhD Degree Programmes please refer to Section 9 for details.

Degree	Study Mode	Normal Study Period	Maximum Study Period
PhD	Full-time	3 years	5 years
		4 years	6 years
	Part-time	6 years	7 years
		8 years	9 years
MPhil	Full-time	2 years	3 years
	Part-time	4 years	5 years

If an RPg student is unable to complete his/her study within the normal study period, he/she shall apply for continuing his/her studies beyond the normal period of study (but within the maximum period of study) for the DoRPgS' approval.

4. Admission

4.1 Admission Requirements

To register for the degree of MPhil, a student shall at least hold a Bachelor's degree with Second Class Honours or above (or equivalent qualification) conferred by a recognised university

To register for the degree of PhD (3-year full-time / 6-year part-time), a student shall normally hold an MPhil or equivalent (a research postgraduate degree with a dissertation as an award requirement) and a Bachelor's degree, conferred by a recognised university.

To register for the degree of PhD (4-year full-time / 8-year part-time), a student shall normally hold a Master's degree and a Bachelor's degree, conferred by a recognised university; OR a Bachelor's degree with First Class Honours (or equivalent qualification), conferred by a recognised university.

PolyU may accept other equivalent qualifications. The decision is made on an individual basis.

4.2 English Language Requirements

The requirements for those who do not have a degree for which English was the language of instruction at a recognised university are:

- An overall score of at least 6.5 in the International English Language Testing System (IELTS) Academic Module; OR
- A Test of English as a Foreign Language (TOEFL) score of 80 or above for the Internet-based test.

All English language test scores are considered valid for two years after the date of the test.

Remarks: Only tests taken at a test centre and scores in one single attempt are accepted.

4.3 Research Proposal & Supervisory Arrangements

Each RPg student registered for PolyU's RPg programme shall follow an approved programme of research and coursework under a Chief Supervisor and Co-supervisors, if appropriate.

With a view to providing both departments and newly-admitted RPg students opportunities to identify the most appropriate supervisors, the DoRPgS' shall follow one of the following supervisory arrangements:

- For an RPg student admitted with a detailed research proposal and a proposed Chief Supervisor, the DoRPgS' shall (i) assign a Chief Supervisor and (ii) assign Co-supervisors as appropriate when considering the application and approving the admission.
- For an RPg student admitted without being assigned a Chief Supervisor and without an approved research project at the point of admission, i.e., on the first day of his/her affiliation with the Department, the Department is obliged to assign the most suitable staff member(s) as supervisor(s) within four months of admission, and the RPg student and his/her supervisor(s) are required to formulate a research proposal for the DoRPgS' approval within four months of admission.

Please refer to the *Research Postgraduate Student Handbook* from the Graduate School (GS) for a clear statement of the roles and responsibilities of the various parties involved in research supervision. [1]

4.4 Application Procedures

The main application deadline for PolyU research postgraduate programme is 31 May each year. Applicants should submit an online application and settle the application fee before the application deadline via the RPgAdmission System.

The Hong Kong PhD Fellowship Scheme (HKPFS), established by the Hong Kong Research Grants Council (RGC), calls for applications around September each year. To apply for HKPFS via PolyU, applicants should file an initial application to the RGC via the HKPFS Electronic System to obtain a reference number. Applicants must quote the HKPFS reference number allocated by the RGC in their applications to PolyU.

Applicants may log-in to the RPgAdmission System to check their application status (e.g., notification of interview/test and admission offer) at any time.

Please refer to "*Importance Notes to Applicants*" under "*e-prospectus*" for Research Postgraduate for detailed application information and procedures. [2]

5. Registration and Progress

For research students, each academic year is divided into three equal semesters and term (i.e., 4 months for each semester/term) as follows:

Semester One	Semester Two	Summer Term
1 September to 31 December	1 January to 30 April	1 May to 31 August

Students are required to commence their study at PolyU and report study commencement at the General Office of the host department with the schedule as follows:

Semester One	Semester Two	Summer Term
1 September or 1 st day of the semester, whichever is earlier	1 st working day after 1 January	1 st working day after 1 May

5.1 Confirmation of Registration

An RPg student, including a Collaborative PhD/Dual PhD student, is required to have his/her registration confirmed according to the deadline as stipulated below. The deadline shall follow the equal semester/term arrangement.

Programme	Deadline for Confirmation of Registration
2-year full-time MPhil programme	At the end of the first 3 semesters/terms
3-year full-time PhD programme	At the end of the first 5 semesters/terms
4-year full-time PhD programme	At the end of the first 6 semesters/terms
4-year part-time MPhil programme	At the end of the first 6 semesters/terms
6-year part-time PhD programme	At the end of the first 9 semesters/terms
8-year part-time PhD programme	At the end of the first 12 semesters/terms

Application for extension of Confirmation of Registration would only be considered on medical grounds. Medical proof must be attached to the application for approval of the DoRPgS. [1]

Note: Some academic departments may set earlier deadlines for Confirmation of Registration for their RPg students. RPg students should check with their DGO for details

5.2 Progress Monitoring

An RPg student should ensure there is a clear understanding of the communication mechanisms and the frequency of research guidance meetings with the supervisor (usually meetings are more frequent at the start and near completion of the research programme).

All RPg students will be assessed by their academic department annually. Each RPg student is required to submit a progress report via the Annual Research Monitoring System (Research Student) (ARMS) and will be allowed to proceed on with his/her studies subject to satisfactory performance as judged by DRC. [1]

5.3 Deregistration

An RPg student will be de-registered from his/her studies at PolyU on grounds of academic failure in the following circumstances:

- if his/her progress is rated unsatisfactory for two consecutive times; or
- if he/she fails to have his/her registration confirmed by the deadline; or
- if he/she fails to submit the thesis to the office concerned upon the expiry of the maximum period of study; or
- if his/her thesis is deemed unsatisfactory ("Failed" case).

A recommendation for deregistration as a result of unsatisfactory thesis made by the Board of Examiners (BoE) shall be approved or rejected by the Graduate School Board (GSB).

6. Requirements of Graduation

Students should meet the following requirements before they can be considered for graduation:

6.1 English Enhancement Subjects and Research Language Skills Assessment

All research students admitted between the 2018/19 and 2020/21 cohorts are required to take and pass two mandatory English subjects, ELC6001 *“Presentation Skills for Research Students”* and ELC6002 *“Thesis Writing for Research Students”* before their thesis submission. For exemption, RPg students need to pass the Research Language Skills Assessment (RLSA).

All research students admitted from the 2021/22 cohort are required to take the Research Language Skills Assessment (RLSA). Students’ performance on the test will determine if they need to complete the University’s English Enhancement Subjects and which subject(s) they should take. All English Enhancement Subjects (ELC6011, ELC6012 and ENGL6016) are credit-bearing.

6.2 Coursework/Credit Requirements

6.2.1 University Coursework Requirements

All RPg students are required to complete the coursework/credit requirements before thesis submission. Subjects are chosen by the student, with advice from the Chief Supervisor. The University coursework/credit requirements are:

Programme	Credit requirement	<i>RPg students admitted in or after the 2024/25 Cohort</i>
2-year full-time/ 4-year part-time MPhil	9 credits	<ul style="list-style-type: none">- 1 credit from Academic Integrity and Ethics (AIE) Subject*- 2 credits from attending seminars- 6 credits from Faculty compulsory and other elective subjects
3-year full-time/ 6-year part-time PhD	15 credits	<ul style="list-style-type: none">- 1 credit from Academic Integrity and Ethics (AIE) Subject*- 3 credits from attending seminars- 2 credits from Practicum- 9 credits from Faculty compulsory and other elective subjects

4-year full-time/ 8-year part-time PhD	22 credits	<ul style="list-style-type: none"> - 1 credit from Academic Integrity and Ethics (AIE) Subject* - 4 credits from attending seminars - 2 credits from Practicum - 15 credits from Faculty compulsory and other elective subjects
<ul style="list-style-type: none"> - RPg students admitted from the 2021/22 Cohort onwards are required to complete 0 to 5 credits from English Enhancement Subjects in addition to the credit requirement stipulated above. - RPg students admitted from the 2022/23 Cohort onwards are required to complete a non-credit bearing e-module on "Understanding China and the Hong Kong Special Administrative Region, P.R.C." and pass the assessment. 		

**RPg students should choose one AIE subject that best suits their studies*

6.2.2 **Faculty Compulsory and Elective Subjects**

Research students of FCE are required to complete the Faculty compulsory subjects listed below before thesis submission:

RPg students from the 2023/24 Cohort	RPg students admitted in or before the 2022/23 Cohort
<ul style="list-style-type: none"> • <i>CE603 Research Frontiers in Construction and Environment</i> (3 credits) 	<ul style="list-style-type: none"> • <i>CE603 Research Frontiers in Construction and Environment</i> (3 credits) • <i>CE620 Research Methods</i> (3 credits)

Subject to the advice and approval of the Chief Supervisor, students may enroll in subjects offered by the Faculty, by its own departments, by sister departments of PolyU and/or by other universities in Hong Kong, in order to fulfill the credit requirements.

All FCE guided-study subjects were removed *en bloc* from the programme curricula from the 2018/19 academic year.

6.2.3 **Practicum**

To earn one credit for practicum, PhD students will be required to engage in teaching activities/professional service assigned by the Head of Department or his/her delegate for 6 hours/week in any 13-week semester. Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.

Stipend recipients are not allowed to fulfill part of their departmental training requirement through the completion of these compulsory training credits.

PhD Students who are required to undertake teaching supporting activities are required to complete the training programmes organised by the Educational Development Centre, English Language Centre/Chinese Language Centre (as required) before the commencement of any teaching supporting activities.

6.2.4 Attendance at Seminars

All Full-time RPg students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.

All Part-time RPg students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.

RPg students are recommended to complete one credit per year (for FT students) or per two years (for PT students) to fulfill the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for FT students) or per two years (for PT students) to fulfill the research seminar credit requirement.

Please refer to *Research Postgraduate Student Handbook* for detailed requirements [1]

6.2.5 Credit Transfer

Applications for the transfer of credits from recognised previous studies will be endorsed by the DoRPgS with justifications and approved by the Head of Department. Only credits gained from subjects at postgraduate level with a passing mark/grade that have not been used to contribute to an award are acceptable for transfer.

For RPg students admitted in or before 2017/18 cohorts, the validity period for such credit transfer for research degree programmes is defined to be five years from the year of attainment at the time of admission.

For RPg students admitted from the 2018/19 cohort onwards, the validity period for

such credit transfer for research degree programmes is defined to be eight years from the year of attainment at the time of admission. The maximum number of credits transferrable is no more than 50% of the credit requirement of the RPg programme disregarding whether the credits were earned within or outside PolyU.

6.2.6 Subject Exemption

An RPg student may apply for exemption from taking a compulsory subject if he/she has successfully completed a similar subject previously in another programme or already has the associated knowledge/skills via work experience, etc. The application should be considered and approved by the DoRPgS.

If an RPg student is exempted from taking a compulsory subject, the credits associated with the exempted subject will not count towards the credit requirements. It will therefore be necessary for the student to take another subject, to be approved by the Chief Supervisor, in order to satisfy the credit requirements. Such a subject will be considered as an elective subject.

For regulations and procedures governing the credit transfer and subject exemption, please refer to the *Research Postgraduate Student Handbook*. [1]

6.2.7 Qualify GPA Requirements

All RPg students need to complete their coursework with a qualifying GPA of 2.7 or above before submission of their thesis to the relevant offices for oral examination. They may take more subjects than required in order to improve their GPA or in order to strengthen their knowledge. However, subjects taken after thesis submission will not contribute to the qualifying GPA.

6.3 Residence Requirement

Residence provides RPg students with an opportunity to become immersed in the intellectual environment of PolyU. Also included in the residence are periods during which students' research requires off-campus field or non-PolyU laboratory work. The residence requirements for the MPhil/PhD Programmes are as follows:

Programme	Residence Requirement
2-year FT / 4-year PT MPhil programme	2 regular semesters
3-year FT / 6-year PT PhD programme	3 regular semesters
4-year FT / 8-year PT PhD programme	4 regular semesters

All RPg students must fulfill the residence requirement before thesis submission [1]

In addition to the residence requirement, FT RPg students are required to be on campus full-time and consequently in such geographical proximity as to be able to participate fully in PolyU activities associated with the RPg programme.

Where an RPg student needs to conduct his/her research outside Hong Kong, adequate supervision arrangements must be proposed by the Chief Supervisor and approved by the DoRPgS for study periods spent outside Hong Kong.

Leave taken by the RPg students during their studies at PolyU will be counted towards their residence requirement of PolyU.

6.4 Thesis Requirements

On completion of an approved programme of study and research, an RPg student must submit a thesis to PolyU (which must be before the end of his/her maximum period of study) and defend it in an oral examination.

If an RPg student is unable to complete his/her studies within the normal study period, he/she shall apply for continuing his/her studies beyond the normal period of study (but within the maximum period of study) for the DoRPgS' approval. Any RPg student who fails to submit his/her thesis to the relevant offices by the end of the normal period of study is required to pay a continuation fee regardless of whether or not he/she is receiving the scholarship.

Research students of FCE need to complete their coursework with a stipulated qualifying GPA before they can submit the thesis for examination.

MPhil and PhD theses should consist of the RPg student's own account of his/her investigations and be integrated and coherent piece of work. The thesis should be presented in English. Permission must be sought preferably at the point of admission, if another language, which is considered more appropriate to the subject, is to be used in the presentation of the thesis. Strong justifications on academic grounds must be provided to substantiate that the use of English will adversely affect the clarity of the thesis should another language be used. [1]

7. Award of Degree

A PhD or MPhil degree is awarded to a student who, upon completing an approved programme of study and research, submits a thesis presenting the results of his/her research and satisfies the examiners in an oral examination (and other examinations if required) in matters relevant to the subject of the thesis. Students must also complete all of the required coursework before submitting their theses.

8. Financial Assistantship

8.1 Scholarships

PolyU offers different scholarship schemes including fellowships to eligible FT RPg students on the basis of academic merit. These fellowships and scholarships aim to allow the FT RPg students to fully focus on their studies. Since the awardees are FT RPg students instead of employees of PolyU, the fellowships and scholarships will not be subject to taxation.

Hong Kong PhD Fellowship Scheme (HKPFS)

HKPFS, established by the Hong Kong Research Grants Council (RGC), aims to support the best and brightest students in the world with a prestigious fellowship to pursue their PhD studies in Hong Kong. The Scheme calls for application in September each year. [3]

PolyU Presidential PhD Fellowship Scheme (PPPFS)

PPPFS is a prestigious scheme designed for top candidates from around the world with exceptional academic/research achievements to pursue their PhD studies.

International PhD Fellowship Scheme (IPFS)

IPFS aims to attract and recruit high-calibre foreign students to pursue their PhD studies.

PolyU Sports Scholarship Scheme for RPg Students (PSSS)

PSSS is for PhD applicants who have a record of sporting success at national and/or international levels. Successful applicants will receive mentorship to pursue dual-track developments in study and sports.

PolyU Research Postgraduate Scholarship (PRPgS)

PRPgS aims to provide financial support to PhD and MPhil students during their normal study period, allowing them to fully focus on their studies.

8.2 Associate Money and Conference Attendance Grant

RPg students admitted in or before the 2021/22 cohort, irrespective of the funding source, should be provided with Associated Money during the normal study period (with a reference amount of HK\$20,000/year for FT RPg students and HK\$10,000/year for PT RPg students).

All RPg students, irrespective of funding source, should be provided with Conference Grant during their studies at PolyU.

They are allowed to make use of the Conference Grant up to the date of oral examination. The use of Conference Grant is not allowed after an RPg student has attended his/her oral examination.

There is no restriction on the number of times an RPg student can be supported by Conference Grant for conference attendance, as long as the total amount of Conference Grant allocated to him/her throughout his/her studies does not exceed HK\$25,000 (for awardees of the Hong Kong PhD Fellowship Scheme, the prevailing amount of conference grant can be found on the GS website).

A maximum amount of HK\$20,000 can be granted for each application. The amount of Conference Grant to be allocated for each application is subject to approval of the Chief Supervisor and the budget owner of departmental account/departmental earnings account/project account.

9. Dual PhD Degree Programmes / Joint PhD Supervision Programmes Leading to a PolyU Degree

The Dual PhD Degree Programmes offer full-time PhD students the opportunities to benefit from shared research excellence in various disciplines between PolyU and its prestigious partners. After completing the Dual PhD Degree Programmes, students will obtain a PhD degree conferred by PolyU and a PhD degree conferred by partner university.

The Joint PhD Supervision Programmes Leading to a PolyU Degree aim to establish collaborative programmes to PhD students, who may obtain a doctoral degree from PolyU and a certificate of completion from partner institution/university after completion of the necessary programmes and graduation requirements of PolyU.

Students admitted under these programmes should refer to *Research Postgraduate Student Handbook – Appendix 1* for specific regulations and administrative procedures.

[1]

10. Research/Academic Attachment Opportunities

10.1 Research Student Attachment Programme - Outgoing

The programme provides PolyU PhD students with an opportunity to pursue research attachment at international institutions to foster collaborative research, and enhance students' international networking and global vision.

The programme may range from a minimum of three months to a maximum of one year. Travel expenses and a monthly subsistence allowance will normally be supported, subject to the details announced during the two calls for applications issued each year in September/October and March/April.

11. **References**

[1] Research Postgraduate Student Handbook

<https://www.polyu.edu.hk/gs/rpghandbook/>

[2] Important Notes to Applicants, e-prospectus for Research Postgraduate

<https://www.polyu.edu.hk/study/pg/research-postgraduate/research-postgraduate-important-notes-applicants>

[3] Hong Kong PhD Fellowship Scheme (HKPFS)

<https://www.polyu.edu.hk/gs/prospective-students/hkpfs/>

Part II

FCE Research
Postgraduate
Programmes

Department of
Building Environment and
Energy Engineering

Department of Building Environment and Energy Engineering

1. Introduction

The Department of Building Environment and Energy Engineering (BEEE), originally named Building Services Engineering (BSE), was officially established in December 1981, and has become one of the largest BEEE departments worldwide. As a leading provider of trained professionals in building services for the unique environment of Hong Kong, BEEE engages in a wide range of research activities organised in three themes, namely Building Energy, Building Environment and Building Safety and Resilience, with focuses on enhancing the quality of the environment, energy efficiency, the use of renewable energy, and the safety and resilience of buildings to effectively address the contemporary concerns and future challenges of urban environments. Its core mission is to devise and improve engineering systems to promote the health and well-being of building occupants by providing a sanctuary from the elements and the extremes of temperature, noise, light, toxins and pathogens at the lowest cost of energy and resources. BEEE offers a full range of programmes leading to the awards of Doctor of Philosophy, Master of Philosophy, Master of Engineering, Master of Science and Bachelor of Engineering serving the needs of the local industry.

BEEE contributes to PolyU's world ranking of 14th in QS World University Rankings by Subject 2024, Architecture and Built Environment and 14th in QS World University Rankings by Subject 2024, Civil and Structural Engineering. The expertise of BEEE academic staff spans a wide range of disciplines, including the aspects of sustainability; building energy, heating, ventilation and air-conditioning systems; fire and safety engineering; electrical technology; public health; indoor environmental engineering; architectural engineering; computer-aided design and facilities management.

2. Programme Rationale and Aims

The PhD and MPhil degree programmes aim to provide rigorous training to students who aspire to become researchers or scholars capable of conducting independent and original research, and producing research findings that are relevant and significant to their chosen field of specialisation. The objectives of the programme of study are to equip students with rigour and wit. To be awarded the degree, students must demonstrate their research competence by submitting a thesis and successfully defending it. This is to ensure that students have attained the appropriate/requisite standard and acquired ability to:

- fully understand and critically evaluate the literature related to their chosen area of study;
- identify problems of relevance and significance worthy of investigation;
- formulate the problems into testable pieces amenable to rigorous investigation;
- apply appropriate research methodology to conduct the investigation;
- perform careful and thorough analysis from which valid conclusions are drawn; and
- present the findings in a clear, lucid and cogent manner.

3. PhD/MPhil Programmes

BEEE offers the following research postgraduate programmes:

Programme Title/Award: Doctor of Philosophy (PhD), & Master of Philosophy (MPhil)

Research areas:

- Building and Environment
- Building Energy
- Building Safety and Resilience
- Electrical Services
- Facility Management

4. Intended Learning Outcomes and Curriculum Maps for Individual Programmes

4.1 PhD Programme (Area: Building and Environment)

4.1.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in</p>	<p>3. Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in</p>

<p>professional contexts and formulate sophisticated original solutions.</p> <p>They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>	<p>professional contexts and formulate sophisticated original solutions.</p> <p>They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>
<p>Effective communicators and collaborators</p> <p>PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.</p>	<p>4. Effective communicators and collaborators</p> <p>PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.</p>
<p>Adaptable and resilient lifelong learners</p> <p>PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>	<p>5. Adaptable and resilient lifelong learners</p> <p>PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>

4.1.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II/III/IV	BSE6105-BSE6106# Practicum I/II	Thesis#
1. PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.				✓	✓	✓			✓	✓			✓	✓		✓
2. PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues. They should also be well-versed in research skills and be able to	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.																
3. PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions. They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/professional endeavours.	✓	✓	✓	✓	✓	✓										✓
5. PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	✓	✓	✓	✓	✓	✓										✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.2 MPhil Programme (Area: Building and Environment)

4.2.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>They should also be able to formulate</p>	<p>3. Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>They should also be able to formulate</p>

individual research tasks and develop well-reasoned solutions.	individual research tasks and develop well-reasoned solutions.
Effective communicators and collaborators MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.	4. Effective communicators and collaborators MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.
Adaptable and resilient lifelong learners MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.	5. Adaptable and resilient lifelong learners MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.

4.2.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II	Thesis#
1. MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.				✓	✓				✓				✓	✓	✓
2. MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues. They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

3. MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions. They should also be able to formulate individual research tasks and develop well-reasoned solutions.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.	✓	✓	✓	✓	✓	✓									✓
5. MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.	✓	✓	✓	✓	✓	✓									✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.3 PhD Programme (Area: Building Energy)

4.3.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Social responsibility</p> <p>PhD graduates in Building Energy should demonstrate foresight and originality in addressing emerging and unforeseen energy challenges at local, national, and global levels, be able to tackle highly complex issues and make responsible decisions, and lead initiatives that promote sustainable energy practices with integrity and pride, contributing to a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. Professional competence</p> <p>PhD graduates in Building Energy should be able to critically apply and extend knowledge at the forefront of building energy research through original contributions, anticipate future technological needs in the field, address emerging interdisciplinary issues, and conduct independent research that significantly advances the understanding and application of building energy technologies.</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p>	<p>3. Critical thinking</p> <p>PhD graduates in Building Energy should be able to engage in critical inquiry of complex energy issues, make informed judgments in the absence of complete data, and conceptualize, solve sophisticated problems within professional contexts, and demonstrate robust logical</p>

<p>They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>	<p>thinking to identify and formulate original research problems and develop innovative solutions in building energy.</p>
<p>Effective communicators and collaborators</p> <p>PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.</p>	<p>4. Effective communication and collaboration capability</p> <p>PhD graduates in Building Energy should be able to effectively communicate complex energy concepts to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic and professional settings.</p>
<p>Adaptable and resilient lifelong learners</p> <p>PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>	<p>5. Lifelong learning capability</p> <p>PhD graduates in Building Energy should engage in a lifelong pursuit of knowledge with a deep sense of purpose, critically reflect on their learning approaches and adapt to new situations, and learn from failures and continuously refine their understanding and skills in the field of building energy.</p>

4.3.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II/III/IV	BSE6105-BSE6106# Practicum I/II	Thesis#
1. PhD graduates in Building Energy should demonstrate foresight and originality in addressing emerging and unforeseen energy challenges at local, national, and global levels, be able to tackle highly complex issues and make responsible decisions, and lead initiatives that promote sustainable energy practices with integrity and pride, contributing to a sustainable future.				✓	✓			✓	✓			✓	✓	✓		
2. PhD graduates in Building Energy should be able to critically apply and extend knowledge at the forefront of building energy research through original contributions, anticipate future technological needs in the field, address emerging interdisciplinary issues, and conduct independent research that significantly advances the understanding and application of building energy technologies.	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

3. PhD graduates in Building Energy should be able to engage in critical inquiry of complex energy issues, make informed judgments in the absence of complete data, and conceptualize, solve sophisticated problems within professional contexts, and demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions in building energy.	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. PhD graduates in Building Energy should be able to effectively communicate complex energy concepts to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic and professional settings.	✓		✓	✓											✓	✓
5. PhD graduates in Building Energy should engage in a lifelong pursuit of knowledge with a deep sense of purpose, critically reflect on their learning approaches and adapt to new situations, and learn from failures and continuously refine their understanding and skills in the field of building energy.	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.4 MPhil Programme (Area: Building Energy)

4.4.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Social responsibility</p> <p>MPhil graduates in Building Energy should demonstrate a critical awareness of energy-related issues in local, national, and global contexts, be able to address complex energy challenges and make responsible decisions, and lead initiatives that promote sustainable energy solutions for the benefit of society.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. Professional competence</p> <p>MPhil graduates in Building Energy should be able to critically apply advanced knowledge of building energy systems and technologies in diverse professional settings, leverage emerging technologies to enhance energy efficiency and sustainability, conduct independent research, and contribute to advancements in the field of building energy.</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>They should also be able to formulate</p>	<p>3. Critical thinking</p> <p>MPhil graduates in Building Energy should be able to evaluate complex energy data and arguments, make informed decisions even with incomplete information, identify and analyse energy-related problems in complex situations and develop innovative solutions to improve energy performance in buildings.</p>

individual research tasks and develop well-reasoned solutions.	
Effective communicators and collaborators MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.	4. Effective communication and collaboration capability MPhil graduates in Building Energy should be able to effectively communicate complex energy concepts to a variety of audiences, including stakeholders and interdisciplinary teams, and foster collaboration in projects that require intercultural and interdisciplinary cooperation to achieve sustainable energy outcomes.
Adaptable and resilient lifelong learners MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.	5. Lifelong learning capability MPhil graduates in Building Energy should engage in continual professional development in the field of building energy, refine their skills and knowledge, adapt to new learning environments and technologies, and demonstrate resilience in overcoming challenges and setbacks in their professional journey.

4.4.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II	Thesis#
1. MPhil graduates in Building Energy should demonstrate a critical awareness of energy-related issues in local, national, and global contexts, be able to address complex energy challenges and make responsible decisions, and lead initiatives that promote sustainable energy solutions for the benefit of society.				✓	✓			✓	✓			✓	✓	✓	
2. MPhil graduates in Building Energy should be able to critically apply advanced knowledge of building energy systems and technologies in diverse professional settings, leverage emerging technologies to enhance energy efficiency and sustainability, conduct independent research, and contribute to advancements in the field of building energy.	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. MPhil graduates in Building Energy should be able to evaluate complex energy data and arguments, make informed decisions even with incomplete information, identify and analyse energy-related problems in	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

complex situations and develop innovative solutions to improve energy performance in buildings.															
4. MPhil graduates in Building Energy should be able to effectively communicate complex energy concepts to a variety of audiences, including stakeholders and interdisciplinary teams, and foster collaboration in projects that require intercultural and interdisciplinary cooperation to achieve sustainable energy outcomes.	✓		✓	✓										✓	✓
5. MPhil graduates in Building Energy should engage in continual professional development in the field of building energy, refine their skills and knowledge, adapt to new learning environments and technologies, and demonstrate resilience in overcoming challenges and setbacks in their professional journey.	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.5 PhD Programme (Area: Building Safety and Resilience)

4.5.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.</p> <p>3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p>	<p>4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.</p>

<p>They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>	
<p>Effective communicators and collaborators</p> <p>PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.</p>	<p>5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively</p>
<p>Adaptable and resilient lifelong learners</p> <p>PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>	<p>6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment</p>

4.5.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II/III/IV	BSE6105-BSE6106# Practicum I/II	Thesis#
1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.	✓	✓	✓	✓	✓	✓						✓		✓		✓
2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner.				✓		✓		✓	✓	✓	✓	✓		✓		✓
4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.	✓	✓	✓	✓	✓	✓						✓		✓		✓
5. To be able to work collaboratively, write high-quality technical	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓

documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively.																
6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.	✓	✓	✓			✓						✓		✓	✓	✓

**0-5 credits subject to RSLA result*

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.6 MPhil Programme (Area: Building Safety and Resilience)

4.6.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.</p> <p>3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p>	<p>4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.</p>

<p>They should also be able to formulate individual research tasks and develop well-reasoned solutions.</p>	
<p>Effective communicators and collaborators</p> <p>MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively</p>
<p>Adaptable and resilient lifelong learners</p> <p>MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment</p>

4.6.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II	Thesis#
1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.	✓	✓	✓	✓	✓	✓						✓		✓	✓
2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner.				✓		✓		✓	✓	✓	✓	✓		✓	✓
4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.	✓	✓	✓	✓	✓	✓						✓		✓	✓

5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively.	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓	✓
6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.	✓	✓	✓			✓							✓		✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.7 PhD Programme (Area: Electrical Services)

4.7.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.</p> <p>3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>They should also demonstrate robust</p>	<p>4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.</p>

logical thinking to identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively
Adaptable and resilient lifelong learners PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment

4.7.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II/III/IV	BSE6105-BSE6106# Practicum I/II	Thesis#
1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.	✓	✓	✓	✓	✓	✓								✓		✓
2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner.				✓		✓		✓	✓	✓				✓		✓
4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.	✓	✓	✓	✓	✓	✓								✓		✓

5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively.	✓	✓	✓	✓	✓	✓								✓		✓
6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.	✓	✓	✓			✓								✓	✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.8 MPhil Programme (Area: Electrical Services)

4.8.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.</p> <p>3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p>	<p>4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.</p>

<p>They should also be able to formulate individual research tasks and develop well-reasoned solutions.</p>	
<p>Effective communicators and collaborators</p> <p>MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively</p>
<p>Adaptable and resilient lifelong learners</p> <p>MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment</p>

4.8.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II	Thesis#
1. To be able to tackle emerging and highly complex issues with integrity and pride for the benefit of society and a sustainable future.	✓	✓	✓	✓	✓	✓								✓	✓
2. To possess state-of-the-art expertise and knowledge in the area of study, and to be able to identify critical issues or formulate problems in the subject area.				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
3. To carry out independent and original research with critical and creative thinking by developing effective research objectives, plan, and implement research work in a professional manner.				✓		✓		✓	✓	✓				✓	✓
4. To be able to tackle with complex issues with robust logical thinking to identify the research problem and develop innovative solutions, even in the absence of sufficient information.	✓	✓	✓	✓	✓	✓								✓	✓

5. To be able to work collaboratively, write high-quality technical documents about the research work, and communicate the results and findings with both non-specialist and professionals effectively.	✓	✓	✓	✓	✓	✓									✓	✓
6. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.	✓	✓	✓			✓									✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.9 PhD Programme (Area: Facility Management)

4.9.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To be able to critically analyze and address complex local, national, and global challenges with foresight and originality in the context of facility management, as well as exhibit leadership qualities that reflect integrity and ethical responsibility, fostering a strong sense of national pride while promoting sustainable solutions that benefit society and contribute to a global perspective.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To be able to critically apply advanced knowledge and research skills in facility management, effectively addressing complex interdisciplinary challenges while anticipating future technological needs, thus making significant contributions to the advancement of knowledge and professional practice.</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>They should also demonstrate robust</p>	<p>3. To be able to critically analyze complex problems, employ creative thinking to develop innovative solutions, and apply rigorous methodologies to evaluate outcomes, thereby contributing to effective decision-making and transformative practices in the field of facility management.</p>

logical thinking to identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	4. To be able to communicate complex ideas clearly and persuasively to diverse audiences, collaborate effectively within interdisciplinary teams, and engage in constructive dialogue, thereby enhancing understanding and fostering partnerships in academic/professional contexts.
Adaptable and resilient lifelong learners PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	5. To be able to engage in a thorough and enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.

4.9.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II/III/IV	BSE6105-BSE6106# Practicum I/II	Thesis#
1. To be able to critically analyze and address complex local, national, and global challenges with foresight and originality in the context of facility management, as well as exhibit leadership qualities that reflect integrity and ethical responsibility, fostering a strong sense of national pride while promoting sustainable solutions that benefit society and contribute to a global perspective.	✓			✓	✓				✓							✓
2. To be able to critically apply advanced knowledge and research skills in facility management, effectively addressing complex interdisciplinary challenges while anticipating future technological needs, thus making significant contributions to the advancement of knowledge and professional practice.					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

3. To be able to critically analyze complex problems, employ creative thinking to develop innovative solutions, and apply rigorous methodologies to evaluate outcomes, thereby contributing to effective decision-making and transformative practices in the field of facility management.					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
4. To be able to communicate complex ideas clearly and persuasively to diverse audiences, collaborate effectively within interdisciplinary teams, and engage in constructive dialogue, thereby enhancing understanding and fostering partnerships in academic/professional contexts.	✓	✓	✓											✓	✓	✓
5. To be able to engage in a thorough and enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.														✓	✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.10 MPhil Programme (Area: Facility Management)

4.10.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To be able to specifically address current local, national, and global challenges in the context of facility management, as well as exhibit leadership qualities that reflect integrity and ethical responsibility, fostering a significant sense of national pride while promoting sustainable solutions that benefit society and contribute to a global perspective.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To be able to critically apply advanced knowledge, research skills and contemporary technologies in facility management to address complex interdisciplinary issues, thus making valuable contributions to the advancement of knowledge and professional practice.</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>They should also be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>3. To be able to critically analyze complex problems, employ logical thinking to develop creative solutions, and apply rigorous methodologies to evaluate outcomes, thereby contributing to rational decision-making and best practices in the field of facility management.</p>

<p>Effective communicators and collaborators</p> <p>MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>4. To be able to communicate ideas clearly and persuasively to diverse audiences, collaborate effectively within interdisciplinary teams, thereby enhancing partnerships in academic/professional contexts.</p>
<p>Adaptable and resilient lifelong learners</p> <p>MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>5. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.</p>

4.10.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BSE6001 Computational Fluid Dynamics	BSE6004 Fire Science and Fire Safety Engineering	BSE6005 Indoor and Outdoor Environmental Quality Evaluation & Simulation	BSE6101-BSE6104# Research Seminar I/II	Thesis#
1. To be able to specifically address current local, national, and global challenges in the context of facility management, as well as exhibit leadership qualities that reflect integrity and ethical responsibility, fostering a significant sense of national pride while promoting sustainable solutions that benefit society and contribute to a global perspective.	✓			✓	✓				✓						✓
2. To be able to critically apply advanced knowledge, research skills and contemporary technologies in facility management to address complex interdisciplinary issues, thus making valuable contributions to the advancement of knowledge and professional practice.					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. To be able to critically analyze complex problems, employ logical thinking to develop creative solutions, and apply rigorous methodologies to evaluate outcomes, thereby					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

contributing to rational decision-making and best practices in the field of facility management.															
4. To be able to communicate ideas clearly and persuasively to diverse audiences, collaborate effectively within interdisciplinary teams, thereby enhancing partnerships in academic/professional contexts.	✓	✓	✓											✓	✓
5. To be able to engage in an enduring quest for knowledge and for continual academic/professional development in a dynamically changing environment.														✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

Department of
Building and Real Estate

Department of Building and Real Estate

1. Introduction

BRE's vision is to become a world-class academic department in the construction and real estate field. The construction and real estate industry (the Industry) has played a key role in positioning Hong Kong as one of the most recognizable, dynamic and admired cities in the world. It has been an instrumental driver of economic growth and enabler of social development for many generations. While the Industry is faced with challenges from traditional practices, it also embraces great opportunities arising from rapid transformation towards digitalization, innovation and adoption of advanced technologies for sustainable development.

To achieve our vision and meet various industrial and societal needs, BRE engages in high quality impactful research with local, national and global significance through four focus research areas, 1) construction health and safety, 2) digital construction, 3) sustainable urban systems with emphasis on digital construction research and 4) sustainable construction. We emphasize the importance of digitization and sustainability for a broader impact of research in academia, as well as translational potential and value to industry, business and the community.

2. Programme Rationale and Aims

The Research Postgraduate Programmes (PhD and MPhil) aim to train and nurture students to become researchers or scholars capable of conducting independent and original research, and producing significant research findings relevant to their chosen field of specialisation. The main objective of the programmes is to equip students with the knowledge, skills and abilities to conduct academic research work with rigour and integrity. To be awarded the degree, students must demonstrate their independent research competence by submitting a thesis and successfully defending it in an oral examination. This is to ensure that students have attained the required standard and are able to:

- critically evaluate the literature and acquire an in-depth understanding of their chosen area of study;
- identify scientific problems worthy of investigation;
- apply solid and appropriate research methods to conduct the investigation;
- carefully and thoroughly analyse the research findings to reach sound conclusions; and present the research findings in a clear and logical manner.

3. PhD/MPhil Programmes

BRE offers the following research postgraduate programmes:

Programme Title/Award: Doctor of Philosophy (PhD), & Master of Philosophy (MPhil)

Research areas:

- Construction and Real Estate Economics
- Construction and Real Estate Management
- Information and Construction Technology
- Urban Sustainability Policy

4. Intended Learning Outcomes and Curriculum Maps for Individual Programmes

4.1 PhD Programme (Area: Construction and Real Estate Economics)

4.1.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Economics.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Also demonstrate robust logical thinking to</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Economics through the generation of new knowledge.</p>

identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and nonspecialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. Develop effective communication skills for both academic and non-academic communities.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Economics through lifelong learning.

4.1.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE674# Attendance in research seminars/ workshops/ conferences	BRE675-BRE676# Practicum	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Economics.					✓		✓	✓		✓	✓	✓			✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓			✓
4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Economics through the generation of new knowledge.					✓		✓			✓	✓	✓			✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Economics through lifelong learning.			✓	✓	✓	✓							✓	✓	✓	✓
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*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.2 MPhil Programme (Area: Construction and Real Estate Economics)

4.2.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Economics.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions. They should also be able to formulate individual research tasks and develop well-reasoned solutions.</p> <p>Also be able to formulate individual research tasks and develop well-reasoned</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Economics.</p>

solutions.	
<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. Develop effective communication skills for both academic and non-academic communities.</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Economics through lifelong learning.</p>

4.2.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE672# Attendance in research seminars/ workshops/ conferences	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Economics.					✓		✓	✓		✓	✓	✓		✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓		✓
4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Economics.					✓		✓			✓	✓	✓		✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Economics through lifelong learning.			✓	✓	✓	✓							✓	✓	✓
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**0-5 credits subject to RSLA result*

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.3 PhD Programme (Area: Construction and Real Estate Management)

4.3.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Management.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Also demonstrate robust logical thinking to identify and formulate original research</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Management through the generation of new knowledge.</p>

problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and nonspecialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. Develop effective communication skills for both academic and non-academic communities.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Management through lifelong learning.

4.3.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE674# Attendance in research seminars/ workshops/ conferences	BRE675-BRE676# Practicum	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Management.					✓		✓	✓		✓	✓	✓			✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓			✓
4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Management through the generation of new knowledge.					✓		✓			✓	✓	✓			✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Management through lifelong learning.			✓	✓	✓	✓							✓	✓	✓	
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**0-5 credits subject to RSLA result*

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.4 **MPhil Programme (Area: Construction and Real Estate Management)**

4.4.1 **Programme Intended Learning Outcomes against Institutional Learning Outcomes**

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Management.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Also be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Management.</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. Develop effective communication skills for both academic and non-academic communities.</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Management through lifelong learning.</p>

4.4.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE672# Attendance in research seminars/ workshops/ conferences	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Construction and Real Estate Management.					✓		✓	✓		✓	✓	✓		✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓		✓
4. Develop the ability to solve complex and challenging problems related to Construction and Real Estate Management.					✓		✓			✓	✓	✓		✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Construction and Real Estate Management through lifelong learning.			✓	✓	✓	✓							✓	✓	✓
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**0-5 credits subject to RSLA result*

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.5 PhD Programme (Area: Information and Construction Technology)

4.5.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Information and Construction Technology.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Also demonstrate robust logical thinking to identify and formulate original research</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Information and Construction Technology through the generation of new knowledge.</p>

problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and nonspecialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. Develop effective communication skills for both academic and non-academic communities.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Information and Construction Technology through lifelong learning.

4.5.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE674# Attendance in research seminars/ workshops/ conferences	BRE675-BRE676# Practicum	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Information and Construction Technology.					✓		✓	✓		✓	✓	✓			✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓			✓
4. Develop the ability to solve complex and challenging problems related to Information and Construction Technology through the generation of new knowledge.					✓		✓			✓	✓	✓			✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Information and Construction Technology through lifelong learning.			✓	✓	✓	✓							✓	✓	✓	
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*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.6 MPhil Programme (Area: Information and Construction Technology)

4.6.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Information and Construction Technology.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Also be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Information and Construction Technology.</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. Develop effective communication skills for both academic and non-academic communities.</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Information and Construction Technology through lifelong learning.</p>

4.6.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE672# Attendance in research seminars/ workshops/ conferences	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Information and Construction Technology.					✓		✓	✓		✓	✓	✓		✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓		✓
4. Develop the ability to solve complex and challenging problems related to Information and Construction Technology.					✓		✓			✓	✓	✓		✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Information and Construction Technology through lifelong learning.			✓	✓	✓	✓							✓	✓	✓
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**0-5 credits subject to RSLA result*

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.7 PhD Programme (Area: Urban Sustainability Policy)

4.7.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Urban Sustainability Policy.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Also demonstrate robust logical thinking to identify and formulate original research</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Urban Sustainability Policy through the generation of new knowledge.</p>

problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and nonspecialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. Develop effective communication skills for both academic and non-academic communities.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Urban Sustainability Policy through lifelong learning.

4.7.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE674# Attendance in research seminars/ workshops/ conferences	BRE675-BRE676# Practicum	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Urban Sustainability Policy.					✓		✓	✓		✓	✓	✓			✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓			✓
4. Develop the ability to solve complex and challenging problems related to Urban Sustainability Policy through the generation of new knowledge.					✓		✓			✓	✓	✓			✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Urban Sustainability Policy through lifelong learning.			✓	✓	✓	✓							✓	✓	✓	
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*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.8 MPhil Programme (Area: Urban Sustainability Policy)

4.8.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Urban Sustainability Policy.</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Also be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.</p> <p>4. Develop the ability to solve complex and challenging problems related to Urban Sustainability Policy.</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. Develop effective communication skills for both academic and non-academic communities.</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Urban Sustainability Policy through lifelong learning.</p>

4.8.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	BRE612 Productivity in Construction	BRE666 Numerical Methods for Engineers	BRE671-BRE672# Attendance in research seminars/ workshops/ conferences	Thesis#
1. Understand the importance and strategic values of their research by evaluating the societal, economic, and environmental contributions.				✓	✓	✓		✓	✓	✓	✓		✓	✓
2. Develop a systematic and comprehensive understanding of advanced theories, methodologies, and practices in Urban Sustainability Policy.					✓		✓	✓		✓	✓	✓		✓
3. Develop scientific literacy, including critical thinking, analytical skills, and sound research methods.					✓	✓	✓	✓	✓	✓	✓	✓		✓
4. Develop the ability to solve complex and challenging problems related to Urban Sustainability Policy.					✓		✓			✓	✓	✓		✓
5. Develop effective communication skills for both academic and non-academic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓

6. Pursue continuous professional development, adapt to evolving industry trends, and contribute to the advancement in Urban Sustainability Policy through lifelong learning.			✓	✓	✓	✓							✓	✓	✓
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**0-5 credits subject to RSLA result*

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

Department of
Civil and Environmental
Engineering

Department of Civil and Environmental Engineering

1. Introduction

The Department of Civil and Environmental Engineering is dedicated to carry out fundamental and application-oriented research to develop scientific, engineering and management solutions that are appropriate to sustain the urban development in densely-populated cities, such as Hong Kong, in Mainland China and other major cities in Asia. We have a strong team of faculties and have achieved an excellent research and publication track record in civil engineering.

The Research Postgraduate Programmes offered by CEE are a combination of coursework and independent research leading to the degree of Master of Philosophy (MPhil) and Doctor of Philosophy (PhD). All of our academic staff are actively engaged in research activities through a range of funding from UGC, RGC, ITF and other sources. The principal research areas in CEE include: Environmental Engineering & Science; Geotechnical Engineering; Coastal & Hydraulic Engineering; Structural Engineering and Construction & Transportation.

2. Programme Rationale and Aims

The programme of research comprises coursework and thesis and is designed to enable the student to: (1) acquire competence in research methods and scholarship; (2) display sustained independent effort and original thoughts; and (3) to pursue lifelong learning capability for continual professional development. The programmes target to produce academics, researchers or industrial R&D professionals.

The main difference between a MPhil and a PhD degree is that, the MPhil seeks to understand how to stretch the limits of knowledge while a PhD seeks to add to that knowledge by creating more knowledge aside from what is already existent. The degree of Master of Philosophy or Doctor of Philosophy would be awarded to a student who, on completion an approved programme of study and research, presents a thesis embodying the results of his/her research and satisfies the examiners in an oral examination (and other examinations if required) in matters relevant to the subject of the thesis.

MPhil and PhD students are required to satisfactorily investigate or evaluate a chosen area, to show understanding of the context and significance of the work, and to present a clear, complete thesis of a quality worthy of publication.

3. PhD/MPhil Programmes

CEE offers the following research postgraduate programmes:

Programme Title/Award: Doctor of Philosophy (PhD), & Master of Philosophy (MPhil)

Research areas:

- Coastal and Hydraulic Engineering
- Construction and Transportation
- Environmental Engineering and Science
- Geotechnical Engineering
- Structural Engineering

4. Intended Learning Outcomes and Curriculum Maps for Individual Programmes

4.1 PhD Programme (Area: Coastal and Hydraulic Engineering)

4.1.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To create original solutions to emerging and unforeseen issues pertaining to the area of Coastal and Hydraulic Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To demonstrate state-of-the-art expertise and knowledge in Coastal and Hydraulic Engineering and possessed superior competence in research methodologies</p> <p>3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p>	<p>4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies</p>

<p>Demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>	
<p>Effective communicators and collaborators</p> <p>Be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.</p>	<p>5. To be able to disseminate/ communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>	<p>6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Coastal and Hydraulic Engineering</p>

4.1.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6014 Environmental Fluid Mechanics	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6724# Research Seminar 1/2/3/4	CSE6710-CSE6711# Practicum 1/2	Thesis#	Education on " Understanding China and the Hong Kong Special Administrative Region, P.R.C."
1. To create original solutions to emerging and unforeseen issues pertaining to the area of Coastal and Hydraulic Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride						✓			✓		✓	✓		✓		✓	✓
2. To demonstrate state-of-the-art expertise and knowledge in Coastal and Hydraulic Engineering and possessed superior competence in research methodologies				✓	✓			✓	✓		✓	✓		✓		✓	
3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis				✓	✓	✓				✓			✓	✓	✓	✓	
4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies				✓	✓	✓				✓			✓	✓		✓	

5. To be able to disseminate/communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/professional endeavours.	✓	✓	✓			✓	✓						✓	✓	✓	✓	
6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Coastal and Hydraulic Engineering				✓	✓	✓			✓		✓	✓		✓		✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.2 MPhil Programme (Area: Coastal and Hydraulic Engineering)

4.2.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Coastal and Hydraulic Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To demonstrate advanced competence in research methods and possess in-depth knowledge in Coastal and Hydraulic Engineering</p> <p>3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Coastal and Hydraulic Engineering</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms, and foster effective collaborations in intercultural and/or interdisciplinary teams</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. To engage capability for continual professional development through inquiry and reflection on knowledge in Coastal and Hydraulic Engineering</p>

4.2.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6014 Environmental Fluid Mechanics	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6722# Research Seminar 1/2	Thesis#	Education on “ Understanding China and the Hong Kong Special Administrative Region, P.R.C.”
1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Coastal and Hydraulic Engineering in the local, national, and global context and the society with the sense of responsibility and pride						✓			✓		✓	✓	✓	✓	✓	✓
2. To demonstrate advanced competence in research methods and possess in-depth knowledge and skills in Coastal and Hydraulic Engineering				✓	✓			✓	✓		✓	✓		✓	✓	
3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Coastal and Hydraulic Engineering				✓	✓	✓				✓				✓	✓	
4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies				✓	✓	✓				✓			✓	✓	✓	

5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms and foster effective collaborations in intercultural and/or interdisciplinary teams.	✓	✓	✓			✓	✓							✓	✓	
6. To enhance capability for continual professional development through inquiry and reflection on knowledge in Coastal and Hydraulic Engineering				✓	✓	✓			✓		✓	✓	✓	✓	✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.3 PhD Programme (Area: Construction and Transportation)

4.3.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To create original solutions to emerging and unforeseen issues pertaining to the area of Construction and Transportation in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To demonstrate state-of-the-art expertise and knowledge in Construction and Transportation and possessed superior competence in research methodologies</p> <p>3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Demonstrate robust logical thinking to</p>	<p>4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies</p>

identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. To be able to disseminate/ communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Construction and Transportation.

4.3.2 Curriculum Map

Intended Learning Outcomes																		
	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6012 Advances in Geotechnical and Pavement Engineering	CSE6015 Transportation Optimization and Simulation Methods	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6724# Research Seminar 1/2/3/4	CSE6710-CSE6711# Practicum 1/2	Thesis#	Education on “ Understanding China and the Hong Kong Special Administrative Region, P.R.C.”
1. To create original solutions to emerging and unforeseen issues pertaining to the area of Construction and Transportation in the local, national, and global context, contribute to the society with the sense of responsibility and pride						✓			✓		✓	✓	✓		✓		✓	✓
2. To demonstrate state-of-the-art expertise and knowledge in Construction and Transportation and possessed superior				✓	✓			✓	✓		✓	✓	✓		✓		✓	

competence in research methodologies																		
3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis				✓	✓	✓			✓				✓	✓	✓	✓		
4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies				✓	✓	✓			✓				✓	✓		✓		
5. To be able to disseminate/communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/professional endeavours.	✓	✓	✓			✓	✓						✓	✓	✓	✓		
6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Construction and Transportation				✓	✓	✓		✓		✓	✓	✓		✓		✓		

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.4 MPhil Programme (Area: Construction and Transportation)

4.4.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Construction and Transportation in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To demonstrate advanced competence in research methods and possess in-depth knowledge in Construction and Transportation</p> <p>3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Construction and Transportation</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms, and foster effective collaborations in intercultural and/or interdisciplinary teams</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. To engage capability for continual professional development through inquiry and reflection on knowledge in Construction and Transportation</p>

4.4.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6012 Advances in Geotechnical and Pavement Engineering	CSE6015 Transportation Optimization and Simulation Methods	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6722# Research Seminar 1/2	Thesis#	Education on “ understanding China and the Hong Kong Special Administrative Region, P.R.C.”
1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Construction and Transportation in the local, national, and global context and the society with the sense of responsibility and pride						✓			✓		✓	✓	✓	✓	✓	✓	✓
2. To demonstrate advanced competence in research methods and possess in-depth knowledge and skills in Construction and Transportation				✓	✓			✓	✓		✓	✓	✓		✓	✓	
3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Construction and Transportation				✓	✓	✓				✓					✓	✓	
4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies				✓	✓	✓				✓				✓	✓	✓	

5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms and foster effective collaborations in intercultural and/or interdisciplinary teams.	✓	✓	✓			✓	✓									✓	✓	
6. To enhance capability for continual professional development through inquiry and reflection on knowledge in Construction and Transportation				✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.5 PhD Programme (Area: Environmental Engineering and Science)

4.5.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To create original solutions to emerging and unforeseen issues pertaining to the area of Environmental Engineering and Science in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To demonstrate state-of-the-art expertise and knowledge in Environmental Engineering and Science and possessed superior competence in research methodologies</p> <p>3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Demonstrate robust logical thinking to</p>	<p>4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies</p>

identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. To be able to disseminate/ communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Environmental Engineering and Science

4.5.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6013 Life Cycle Performance Management of Concrete Infrastructure	CSE6014 Environmental Fluid Mechanic	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6724# Research Seminar 1/2/3/4	CSE6710-CSE6711# Practicum 1/2	Thesis#	Education on “ Understanding China and the Hong Kong Special Administrative Region, P.R.C.”
	1. To create original solutions to emerging and unforeseen issues pertaining to the area of Environmental Engineering and Science in the local, national, and global context, contribute to the society with the sense of responsibility and pride					✓			✓		✓	✓	✓		✓		✓	✓
	2. To demonstrate state-of-the-art expertise and knowledge in Environmental Engineering and Science and possessed superior competence in research methodologies			✓	✓			✓	✓		✓	✓	✓		✓		✓	
	3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis			✓	✓	✓				✓				✓	✓	✓	✓	

4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies				✓	✓	✓				✓				✓	✓		✓	
5. To be able to disseminate/communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	✓	✓	✓			✓	✓							✓	✓	✓	✓	
6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Environmental Engineering and Science				✓	✓	✓			✓		✓	✓	✓		✓		✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.6 MPhil Programme (Area: Environmental Engineering and Science)

4.6.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Environmental Engineering and Science in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To demonstrate advanced competence in research methods and possess in-depth knowledge in Environmental Engineering and Science</p> <p>3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Environmental Engineering and Science</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms, and foster effective collaborations in intercultural and/or interdisciplinary teams</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. To engage capability for continual professional development through inquiry and reflection on knowledge in Environmental Engineering and Science</p>

4.6.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6013 Life Cycle Performance Management of Concrete Infrastructure	CSE6014 Environmental Fluid Mechanics	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6722# Research Seminar 1/2	Thesis#	Education on “ Understanding China and the Hong Kong Special Administrative Region, P.R.C.”
	1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Environmental Engineering and Science in the local, national, and global context and the society with the sense of responsibility and pride					✓			✓		✓	✓	✓	✓	✓	✓	✓
	2. To demonstrate advanced competence in research methods and possess in-depth knowledge and skills in Environmental Engineering and Science			✓	✓			✓	✓		✓	✓	✓		✓	✓	
	3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Environmental Engineering and Science			✓	✓	✓				✓					✓	✓	

4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies				✓	✓	✓				✓					✓	✓	✓	
5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms and foster effective collaborations in intercultural and/or interdisciplinary teams.	✓	✓	✓			✓	✓									✓	✓	
6. To enhance capability for continual professional development through inquiry and reflection on knowledge in Environmental Engineering and Science				✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.7 PhD Programme (Area: Geotechnical Engineering)

4.7.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To create original solutions to emerging and unforeseen issues pertaining to the area of Geotechnical Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To demonstrate state-of-the-art expertise and knowledge in Geotechnical Engineering and possessed superior competence in research methodologies</p> <p>3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Demonstrate robust logical thinking to</p>	<p>4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies</p>

identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. To be able to disseminate/ communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Geotechnical Engineering

4.7.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6012 Advances in Geotechnical and Pavement Engineering	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6724# Research Seminar 1/2/3/4	CSE6710-CSE6711# Practicum 1/2	Thesis#	Education on "Understanding China and the Hong Kong Special Administrative Region, P.R.C."
1. To create original solutions to emerging and unforeseen issues pertaining to the area of Geotechnical Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride						✓			✓		✓	✓		✓		✓	✓
2. To demonstrate state-of-the-art expertise and knowledge in Geotechnical Engineering and possessed superior competence in research methodologies				✓	✓			✓	✓		✓	✓		✓		✓	
3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis				✓	✓	✓				✓			✓	✓	✓	✓	
4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies				✓	✓	✓				✓			✓	✓		✓	
5. To be able to disseminate/communicate the research ideas and findings	✓	✓	✓			✓	✓					✓	✓	✓	✓	✓	

effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.																	
6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Geotechnical Engineering				✓	✓	✓			✓		✓	✓		✓		✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.8 MPhil Programme (Area: Geotechnical Engineering)

4.8.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Geotechnical Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To demonstrate advanced competence in research methods and possess in-depth knowledge in Geotechnical Engineering</p> <p>3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Geotechnical Engineering</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Be able to formulate individual research</p>	<p>4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies</p>

tasks and develop well-reasoned solutions.	
Effective communicators and collaborators Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.	5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms, and foster effective collaborations in intercultural and/or interdisciplinary teams
Adaptable and resilient lifelong learners Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.	6. To engage capability for continual professional development through inquiry and reflection on knowledge in Geotechnical Engineering

4.8.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6012 Advances in Geotechnical and Pavement Engineering	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6722# Research Seminar 1/2	Thesis#	Education on " Understanding China and the Hong Kong Special Administrative Region, P.R.C."
1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Geotechnical Engineering in the local, national, and global context and the society with the sense of responsibility and pride						✓			✓		✓	✓	✓	✓	✓	✓
2. To demonstrate advanced competence in research methods and possess in-depth knowledge and skills in Geotechnical Engineering				✓	✓			✓	✓		✓	✓		✓	✓	
3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Geotechnical Engineering				✓	✓	✓				✓				✓	✓	
4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies				✓	✓	✓				✓			✓	✓	✓	
5. To be able to disseminate/communicate effectively the	✓	✓	✓			✓	✓							✓	✓	

research findings in publications, conferences and classrooms and foster effective collaborations in intercultural and/or interdisciplinary teams.																	
6. To enhance capability for continual professional development through inquiry and reflection on knowledge in Geotechnical Engineering				✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.9 PhD Programme (Area: Structural Engineering)

4.9.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To create original solutions to emerging and unforeseen issues pertaining to the area of Structural Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>Be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To demonstrate state-of-the-art expertise and knowledge in Structural Engineering and possessed superior competence in research methodologies</p> <p>3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p> <p>Demonstrate robust logical thinking to</p>	<p>4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies</p>

identify and formulate original research problems and develop innovative solutions.	
Effective communicators and collaborators Be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.	5. To be able to disseminate/ communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/ professional endeavours.
Adaptable and resilient lifelong learners Engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.	6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Structural Engineering

4.9.2 Curriculum Map

Intended Learning Outcomes		ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6010 Nonlinear Finite Element Analysis of Structures	CSE6011 Structural Performance Monitoring	CSE6013 Life Cycle Performance Management of Concrete Infrastructure	CSE6014 Environmental Fluid Mechanics	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6724# Research Seminar 1/2/3/4	CSE6710-CSE6711# Practicum 1/2	Thesis#	Education on " Understanding China and the Hong Kong Special Administrative Region, B B C "
1. To create original solutions to emerging and unforeseen issues pertaining to the area of Structural Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride							✓			✓		✓	✓	✓	✓	✓		✓		✓	✓
2. To demonstrate state-of-the-art expertise and knowledge in Structural Engineering and possessed superior competence in research methodologies				✓	✓			✓	✓			✓	✓	✓	✓	✓		✓		✓	

3. To contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis				✓	✓	✓				✓						✓	✓	✓	✓	
4. To become innovative problem solvers with excellent mastery of critical and creative thinking methodologies				✓	✓	✓				✓						✓	✓		✓	
5. To be able to disseminate/communicate the research ideas and findings effectively and efficiently in publications, conferences and classrooms, and establish and sustain interdisciplinary collaborations in academic/professional endeavours.	✓	✓	✓			✓	✓									✓	✓	✓	✓	
6. To engage in an enduring quest for knowledge and an enhanced capability for continual academic (include teaching)/professional development through self-directed research in Structural Engineering				✓	✓	✓			✓		✓	✓	✓	✓	✓		✓		✓	

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.10 MPhil Programme (Area: Structural Engineering)

4.10.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>Demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Structural Engineering in the local, national, and global context, contribute to the society with the sense of responsibility and pride.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>Be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>Also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To demonstrate advanced competence in research methods and possess in-depth knowledge in Structural Engineering</p> <p>3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Structural Engineering</p>
<p>Critical thinkers and creative problem solvers</p> <p>Be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>Be able to formulate individual research tasks and develop well-reasoned solutions.</p>	<p>4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies</p>

<p>Effective communicators and collaborators</p> <p>Be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.</p>	<p>5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms, and foster effective collaborations in intercultural and/or interdisciplinary teams</p>
<p>Adaptable and resilient lifelong learners</p> <p>Engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.</p>	<p>6. To engage capability for continual professional development through inquiry and reflection on knowledge in Structural Engineering</p>

4.10.2

Curriculum Map

Intended Learning Outcomes		ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603*# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	CSE6010 Nonlinear Finite Element Analysis of Structures	CSE6011 Structural Performance Monitoring	CSE6013 Life Cycle Performance Management of Concrete Infrastructure	CSE6014 Environmental Fluid Mechanics	CSE6016 Probability, Statistics, and Machine Learning for Engineers	CSE6017 Turbulent Flow and Modelling	CSE6721-CSE6722# Research Seminar 1/2	Thesis#	Education on “ Understanding China and the Hong Kong Special Administrative Region, P.R.C.”
1. To generate practical and innovative solutions to contemporary issues pertaining to the area of Structural Engineering in the local, national, and global context and the society with the sense of responsibility and pride							✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
2. To demonstrate advanced competence in research methods and possess in-depth knowledge and skills in Structural Engineering					✓	✓			✓	✓		✓	✓	✓	✓	✓		✓	✓	

3. To attain the ability to apply the knowledge and act as leaders in analysing and solving identified issues and problems in Structural Engineering				✓	✓	✓				✓							✓	✓	
4. To become versatile problem solvers with good mastery of critical and creative thinking methodologies				✓	✓	✓				✓							✓	✓	✓
5. To be able to disseminate/communicate effectively the research findings in publications, conferences and classrooms and foster effective collaborations in intercultural and/or interdisciplinary teams.	✓	✓	✓			✓	✓											✓	✓
6. To enhance capability for continual professional development through inquiry and reflection on knowledge in Structural Engineering				✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

Department of
Land Surveying and
Geo-Informatics

Department of Land Surveying and Geo-Informatics

1. Introduction

Established in 1982, the Department of Land Surveying and Geo-Informatics (LSGI) is the only academic unit amongst the local tertiary institutions offering a range of opportunities for education, training and research in the fields of Land Surveying and Geo-Informatics (or Geomatics). The Department has close links with both international and local academic institutions and the professions. By maintaining links with the local professional community through our community service and consultancy activities, our courses and research are oriented towards the needs of Hong Kong.

The Department has identified Urban Informatics and Smart City as its strategic area, with three corresponding focused research directions: a) spatial big data modelling and analytics; b) smart positioning and smart mobility; and c) urban sensing and measurement. As a regional centre of excellence in geomatics research, LSGI is comparable with international reputed academic units in the discipline, as evidenced by both the quantity and quality of the research produced and research grants received.

2. Programme Rationale and Aims

The Research student programmes aim to provide rigorous training to students who aspire to become researchers or scholars capable of conducting independent and original research, and producing research findings that are relevant and significant to their chosen field of specialisation. To be awarded the degree, students must demonstrate their research competence by submitting a thesis and successfully defending it in an oral examination.

Research students (MPhil and/or PhD) must satisfactorily investigate or evaluate a chosen area, demonstrate understanding of the context and significance of the work, display sustained independent effort and original thought, and present a clear, complete thesis of a quality worthy of publication. For PhD students, they are also expected to produce evidence and argument supporting an original proposition or rigorous testing and analysis of others propositions, that results in a significant contribution to knowledge in the subject area.

The research degree programmes are designed in such a way to enable the student to:

- Acquire competence in research methods and scholarship;
- Display sustained independent effort and original thought;
- Develop competence in disseminating and communicating their work; and
- Gain lifelong learning capability.

3. **PhD/MPhil Programmes**

LSGI offers the following research postgraduate programme:

Programme Title/Award: Doctor of Philosophy (PhD), & Master of Philosophy (MPhil)

Research areas:

- Geomatics
- Urban Informatics and Smart City

Geomatics is the discipline of acquiring, processing, managing, modelling and delivering spatially referenced information about the earth and other planets, for a variety of applications such as construction, environment, navigation and transportation. In the discipline of Geomatics, the research areas include Cadastre Survey, Cartography, Geodesy and Geodynamics, Geographic Information Science, GNSS and Positioning systems, hydrographic surveying, Photogrammetry, Navigation technology, Remote Sensing, Utility Surveying.

Urban informatics and Smart Cities is a trans-disciplinary field that draws on three broad domains, i.e. people, place and technology, with ultimate goal of achieving smarter mobility, smart living, smart environment and smart people. This new field is enabled by the increasing availability of big and geographically-rich new urban data, the development of geo-information technologies, and the growth of sensors and connected systems. In the discipline of Urban Informatics and Smart City, the research areas include Urban-space and environment, Urban Systems and Dynamics, Urban Sensing, Ubiquitous Technologies, Big Urban data Analytics and Visualization, etc.

4. Intended Learning Outcomes and Curriculum Maps for Individual Programmes

4.1 PhD Programme (Area: Geomatics)

4.1.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To develop a systematic understanding of advanced Geomatics knowledge and skills.</p> <p>6. To become an independent researcher in Geomatics as well as socially responsible leaders who are deeply connected to their national context while at the same time possessing a broad, global perspective.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To become research-environment ready professionals with strong technical acumen equipped with advanced theoretical knowledge, cutting-edge technology use, innovative research, and practical problem-solving skills.</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in</p>	<p>3. To develop scientific literacy, including critical thinking and creative problem-solving skills, analytical skills and sound research methods.</p>

<p>professional contexts and formulate sophisticated original solutions.</p> <p>They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>	
<p>Effective communicators and collaborators</p> <p>PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborators in academic/professional endeavours.</p>	<p>4. To develop effective communication and collaboration skills for both academic and non-academic communities necessary to work effectively across disciplines, engage with diverse stakeholders, and lead innovative research and development efforts.</p>
<p>Adaptable and resilient lifelong learners</p> <p>PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>	<p>5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, advanced research capabilities, ethical professionalism, and the flexibility to navigate and lead in a rapidly evolving technological and societal landscape.</p>

4.1.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016**# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	LSGI631-LSGI634# Attendance in Research Seminars/ Workshops / Conferences I/II/III/IV	LSGI641-LSGI642# Practicum I/II	LSGI651 Advanced GNSS Technology and Applications	LSGI652 Remote Sensing in Construction, Urban and Environment	Thesis#
1. To develop a systematic understanding of advanced knowledge in Geomatics					✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
2. To become research-environment ready professionals equipped with advanced theoretical knowledge, cutting-edge technology use, and creative problem-solving skills							✓	✓	✓	✓			✓	✓	✓
3. To develop scientific literacy, including critical thinking and analytical skills, and ability to design and conduct scientific research, as well as analyse and interpret data.			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
4. To develop effective communication and collaboration skills for both academic and non-academic communities, and the ability to disseminate research outputs in a professional manner.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, understanding the importance and strategic values of research/ethical professionalism, and participating in a rapidly evolving technological and societal landscape.	✓			✓	✓	✓					✓				✓
6. To become an independent researcher in Geomatics as well as socially responsible professionals who are deeply connected to their national context while at the same time possessing an understanding of global perspective.		✓	✓		✓	✓							✓		✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.2 MPhil Programme (Area: Geomatics)

4.2.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To develop a systematic understanding of advanced Geomatics knowledge and skills.</p> <p>6. To become skilled researcher in Geomatics as well as socially responsible professionals who are deeply connected to their national context while at the same time possessing a broad, global perspective.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To become research-environment ready professionals equipped with advanced theoretical knowledge, cutting-edge technology use, and creative problem-solving skills.</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>They should also be able to formulate</p>	<p>3. To develop scientific literacy, including critical thinking and analytical skills, and ability to design and conduct scientific research, as well as analyse and interpret data.</p>

individual research tasks and develop well-reasoned solutions.	
Effective communicators and collaborators MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.	4. To develop effective communication and collaboration skills for both academic and non-academic communities, and the ability to disseminate research outputs in a professional manner.
Adaptable and resilient lifelong learners MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.	5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, understanding the importance and strategic values of research/ethical professionalism, and participating in a rapidly evolving technological and societal landscape.

4.2.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603# Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	LSG1631-LSG1632# Attendance in Research Seminars/ Workshops / Conferences I/II	LSG1651 Advanced GNSS Technology and Applications	LSG1652 Remote Sensing in Construction, Urban and Environment	Thesis#
1. To develop a systematic understanding of advanced Geomatics knowledge and skills.					✓	✓	✓	✓	✓	✓	✓		✓	✓
2. To become research-environment ready professionals with strong technical acumen equipped with advanced theoretical knowledge, cutting-edge technology use, innovative research, and practical problem-solving skills.							✓	✓	✓	✓			✓	✓
3. To develop scientific literacy, including critical thinking and creative problem-solving skills, analytical skills, and sound research methods.			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
4. To develop effective communication and collaboration skills for both academic and non-academic communities necessary to work effectively across disciplines, engage with diverse stakeholders, and lead innovative research and development efforts.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, advanced research capabilities, ethical professionalism, and the flexibility to navigate and lead in a rapidly evolving technological and societal landscape.	✓			✓	✓	✓						✓			✓
6. To become skilled researcher in Geomatics as well as socially responsible professionals who are deeply connected to their national context while at the same time possessing an understanding of global perspective.		✓	✓		✓	✓								✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.3 PhD Programme (Area: Urban Informatics and Smart City)

4.3.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>PhD graduates should demonstrate foresight and originality in tackling emerging and unforeseen local, national and global challenges, be able to deal with highly complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To develop a systematic understanding of advanced Urban Informatics and Smart City knowledge and skills.</p> <p>6. To become an independent researcher in Urban Informatics and Smart City as well as socially responsible leaders who are deeply connected to their national context while at the same time possessing a broad, global perspective.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>PhD graduates should be able to critically apply knowledge and skills at the forefront of an academic discipline and extend that knowledge through original research, anticipate future technology needs for professional practice, and deal with emerging complex interdisciplinary issues.</p> <p>They should also be well-versed in research skills and be able to critically apply in-depth knowledge in their expertise areas, perform independent research, and make significant and original contributions to the discovery and advancement of knowledge.</p>	<p>2. To become research-environment ready professionals with strong technical acumen equipped with advanced theoretical knowledge, cutting-edge technology use, innovative research, and practical problem-solving skills.</p>
<p>Critical thinkers and creative problem solvers</p> <p>PhD graduates should be able to engage in critical inquiry of complex issues, make astute judgement in the absence of complete data, conceptualise problems in professional contexts and formulate sophisticated original solutions.</p>	<p>3. To develop scientific literacy, including critical thinking and creative problem-solving skills, analytical skills and sound research methods.</p>

<p>They should also demonstrate robust logical thinking to identify and formulate original research problems and develop innovative solutions.</p>	
<p>Effective communicators and collaborators</p> <p>PhD graduates should be able to communicate complex ideas effectively to both specialist and non-specialist audiences, and establish and sustain interdisciplinary collaborators in academic/professional endeavours.</p>	<p>4. To develop effective communication and collaboration skills for both academic and non-academic communities necessary to work effectively across disciplines, engage with diverse stakeholders, and lead innovative research and development efforts.</p>
<p>Adaptable and resilient lifelong learners</p> <p>PhD graduates should engage in an enduring quest for knowledge with a deep sense of purpose, critically reflect on their epistemic beliefs and learning approaches, adapt to new learning situations, and learn from failure.</p>	<p>5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, advanced research capabilities, ethical professionalism, and the flexibility to navigate and lead in a rapidly evolving technological and societal landscape.</p>

4.3.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	LSGI631-LSGI634# Attendance in Research Seminars/ Workshops / Conferences I/II/III/IV	LSGI641-LSGI642# Practicum I/II	LSGI651 Advanced GNSS Technology and Applications	LSGI652 Remote Sensing in Construction, Urban and Environment	Thesis#
1. To develop a systematic understanding of advanced knowledge in Urban Informatics and Smart City					✓	✓	✓	✓	✓	✓	✓		✓	✓	
2. To become research-environment ready professionals equipped with advanced theoretical knowledge, cutting-edge technology use, and creative problem-solving skills							✓	✓	✓	✓			✓	✓	
3. To develop scientific literacy, including critical thinking and creative problem-solving skills, analytical skills, and sound research methods.			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	
4. To develop effective communication and collaboration skills for both academic and non-academic communities, and the ability to disseminate research outputs in a professional manner.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. To develop adaptable and resilient lifelong	✓			✓	✓	✓					✓				✓

learning skills by fostering continuous learning mindsets, understanding the importance and strategic values of research/ethical professionalism, and participating in a rapidly evolving technological and societal landscape.																
6. To become an independent researcher in Urban Informatics and Smart City as well as socially responsible professionals who are deeply connected to their national context while at the same time possessing an understanding of global perspective.		✓	✓		✓	✓								✓		✓

* 0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

4.4 MPhil Programme (Area: Urban Informatics and Smart City)

4.4.1 Programme Intended Learning Outcomes against Institutional Learning Outcomes

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
<p>Socially responsible leaders with a strong sense of national pride and a global outlook</p> <p>MPhil graduates should demonstrate a critical awareness of current issues in local, national and global contexts, be able to deal with complex issues and make responsible decisions, and lead with integrity and pride for the benefit of society and a sustainable future.</p>	<p>1. To develop a systematic understanding of advanced Urban Informatics and Smart City knowledge and skills.</p> <p>6. To become skilled researcher in Urban Informatics and Smart City as well as socially responsible professionals who are deeply connected to their national context while at the same time possessing a broad, global perspective.</p>
<p>Future-ready professionals who possess technical acumen</p> <p>MPhil graduates should be able to critically apply advanced discipline knowledge and scholastic skills in a broad range of professional contexts, make critical use of changing and emerging technologies for work, and deal with complex interdisciplinary issues.</p> <p>They should also be able to critically apply advanced knowledge in their expertise areas, perform research with minimal supervision, and make valuable contributions to the discovery of knowledge.</p>	<p>2. To become research-environment ready professionals equipped with advanced theoretical knowledge, cutting-edge technology use, and creative problem-solving skills.</p>
<p>Critical thinkers and creative problem solvers</p> <p>MPhil graduates should be able to critically evaluate complex information and arguments, make sound judgement in the absence of complete data, identify and analyse problems in complex situations and formulate creative strategic solutions.</p> <p>They should also be able to formulate</p>	<p>3. To develop scientific literacy, including critical thinking and analytical skills, and ability to design and conduct scientific research, as well as analyse and interpret data.</p>

individual research tasks and develop well-reasoned solutions.	
Effective communicators and collaborators MPhil graduates should be able to communicate effectively with a broad range of audiences, and foster effective and harmonious collaboration in an intercultural and/or interdisciplinary team.	4. To develop effective communication and collaboration skills for both academic and non-academic communities, and the ability to disseminate research outputs in a professional manner.
Adaptable and resilient lifelong learners MPhil graduates should engage in continual professional development, reflect on their goals and purposes, refine their learning approaches, adapt to unfamiliar learning situations, and persevere through setbacks.	5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, understanding the importance and strategic values of research/ethical professionalism, and participating in a rapidly evolving technological and societal landscape.

4.4.2 Curriculum Map

Intended Learning Outcomes	ELC6011*# Presentation Skills for Research Students	ELC6012*# Thesis Writing for Research Students	ENGL6016*# Advanced Academic English for Research Students: Publishing and Presenting	Academic Integrity and Ethics (AIE) Subject of students' choice#	CE603* Research Frontiers in Construction and Environment	CE620^ Research Methods	CE631 Simulation and IT Applications in Construction	CE632 Advanced Energy Technologies and Analytics	CE633 Environment and Climate Change	CE634 Urban Big Data	LSGI631-LSGI632# Attendance in Research Seminars/ Workshops / Conferences I/II	LSGI651 Advanced GNSS Technology and Applications	LSGI652 Remote Sensing in Construction, Urban and Environment	Thesis#
1. To develop a systematic understanding of advanced Urban Informatics and Smart City knowledge and skills.					✓	✓	✓	✓	✓	✓	✓		✓	✓
2. To become research-environment ready professionals with strong technical acumen equipped with advanced theoretical knowledge, cutting-edge technology use, innovative research, and practical problem-solving skills.							✓	✓	✓	✓			✓	✓
3. To develop scientific literacy, including critical thinking and creative problem-solving skills, analytical skills, and sound research methods.			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
4. To develop effective communication and collaboration skills for both academic and non-academic communities necessary to work effectively across disciplines, engage with diverse stakeholders, and lead innovative research and development efforts.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5. To develop adaptable and resilient lifelong learning skills by fostering continuous learning mindsets, advanced research capabilities, ethical professionalism, and the flexibility to navigate and lead in a rapidly evolving technological and societal landscape.	✓			✓	✓	✓					✓			✓
6. To become skilled researcher in Urban Informatics and Smart City as well as socially responsible professionals who are deeply connected to their national context while at the same time possessing an understanding of global perspective.		✓	✓		✓	✓							✓	✓

*0-5 credits subject to RSLA result

#Compulsory

^Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort

Part III

Subject Description Forms

List of University / Faculty / Departmental Subjects

Subject Offering Departments		Subject Code	Subject Title
University subjects			
English Language Centre (ELC)		ELC6011 ¹	Presentation Skills for Research Students
		ELC6012 ¹	Thesis Writing for Research Students
Department of English (ENGL)		ENGL6016 ¹	Advanced Academic English for Research Students: Publishing and Presenting
Academic Integrity and Ethics subject of students' choice ²	AF / MM / LGT	AF/MM/LGT5R01	Academic Integrity and Ethics in Business
	HTM	HTM5R02	Academic Integrity and Ethics in Business and Research
	EEE	EEE5R03	Engineering Ethics and Academic Integrity
	HTI	HTI5R04	Academic Integrity and Ethics (Health and Social Sciences)
	CBS	CBS5R05	Professional Ethics and Academic Integrity
	CHC	CHC5R06	Academic Integrity and Ethics in China-related Humanities
	ABCT / AP / FSN	ABCT/AP/FSN5R07	Academic Integrity and Ethics in Science
Faculty subjects			
Faculty of Construction and Environment (FCE)		CE603 ³	Research Frontiers in Construction and Environment
		CE620 ⁴	Research Methods
		CE631	Simulation and IT Applications in Construction
		CE632	Advanced Energy Technologies and Analytics
		CE633	Environment and Climate Change
		CE634	Urban Big Data
Departmental subjects			
Department of Building Environment and Energy Engineering (BEEE)		BSE6001	Computational Fluid Dynamics
		BSE6004	Fire Science and Fire Safety Engineering
		BSE6005	Indoor and Outdoor Environmental Quality Evaluation and Simulation
		BSE6101-6104 ⁵	Research Seminar I/II/III/IV
		BSE6105-6106 ⁶	Practicum I/II

Department of Building and Real Estate (BRE)	BRE612	Productivity in Construction
	BRE666	Numerical Methods for Engineers
	BRE671-674 ⁵	Attendance in research seminars/workshops/conferences
	BRE675-676 ⁶	Practicum
Department of Civil and Environmental Engineering (CEE)	CSE6010	Nonlinear Finite Element Analysis of Structures
	CSE6011	Structural Performance Monitoring
	CSE6012	Advances in Geotechnical and Pavement Engineering
	CSE6013	Life Cycle Performance Management of Concrete Infrastructure
	CSE6014	Environmental Fluid Mechanics
	CSE6015	Transportation Optimization and Simulation Methods
	CSE6016	Probability, Statistics, and Machine Learning for Engineers
	CSE6017	Turbulent Flow and Modelling
	CSE6721-6724 ⁵	Research Seminar 1/2/3/4
Department of Land Surveying and Geo-Informatics (LSGI)	CSE6710-6711 ⁶	Practicum 1/2
	LSGI631-634 ⁵	Attendance in Research Seminars/Workshops/Conferences I/II/III/IV
	LSGI641-642 ⁶	Practicum I/II
	LSGI651	Advanced GNSS Technology and Applications
	LSGI652	Remote Sensing in Construction, Urban and Environment

Notes:

- ^{1.} English enhancement subjects for all RPg students. For exemption, RPg students need to pass the Research Language Skills Assessment (RLSA).
- ^{2.} Compulsory Subjects for all PolyU RPg students
- ^{3.} Compulsory Subject for full-time FCE research students who registered on/after 2 July 2009, and part-time FCE research students who registered on/after 2 July 2014.
- ^{4.} Compulsory for RPg students admitted in the 2022/23 cohort or before; Elective for RPg students admitted in or after the 2023/24 cohort
- ^{5.} Attendance at Seminars is compulsory for all PolyU RPg students (Total 2 credits for MPhil students / Total 3 credits for 3-year PhD students / Total 4 credits for 4-year PhD students).
- ^{6.} Practicum is compulsory for all PolyU PhD students.

University Compulsory Subjects

Subject Description Form

Subject Code	ELC6011
Subject Title	Presentation Skills for Research Students
Credit Value	2
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is designed to improve research students' academic speaking proficiency, enhance their awareness of academic conventions during and academic discussion/presentation, and develop their skills in using clear, appropriate, persuasive and analytical language for their delivery of effective academic presentations.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ organise academic presentations logically by following academic conventions ▪ present research contribution by critically analysing previous research; ▪ use clear, appropriate, persuasive and analytic language for presentations at seminars, conferences and viva; and ▪ defend research logically, critically, and persuasively.
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> 1. Critical analysis of prior research Understanding academic presentation process and the structure; identifying language features of appropriate for academic speaking settings. 2. Awareness of academic conventions Developing awareness of citation practices, and language use adopted in the related disciplines. 3. Inter and intra section connections Using effective signpost language to organize and connect different parts of an academic presentation. 4. Clear, appropriate, persuasive, and analytical language use Summarising, evaluating, and citing sources; reporting and discussing research data; objectively evaluating research contribution.
Teaching / Learning Methodology	<p>In-house learning materials specifically designed for research students by the English Language Centre are used for this subject.</p> <p>The study method is primarily seminar-based and follows a blended delivery approach. Activities include teacher input, class discussion both formally and informally, and presentations both individually and in groups. Flipped learning is integrated in the subject delivering. Providing feedback to peers, engaging in self-reflection, and evaluating other students' presentations are also crucial elements of the instructional framework.</p>

Assessment Methods	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
			a	b	c	d
	Presenting an effective introduction and literature review – video submission	40%	✓	✓	✓	
	Delivering an effective research presentation – in-class individual presentation	60%	✓	✓	✓	✓
	Total	100%				
	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Presenting an effective introduction for an academic study is most challenging for research students. To help them develop related skills, the subject requires that students present the introduction part (including a literature review) only in Assessment 1. This presentation is to be submitted as a short video and thus allows students multiple attempts during the delivery process. After teacher feedback, peer feedback, and self-reflection on the performance of Assessment 1, students should be better equipped to deliver a comprehensive research paper presentation for Assessment 2.</p>					
Student Study Effort Expected	Class contact					
	▪ Seminars					20 Hrs.
	▪ Assessment					6 Hrs.
	Other student study effort:					
	▪ Self-study/preparation for assessments					52 Hrs.
	▪ Total student study effort					78 Hrs.
Reading List and References	<p><u>References:</u></p> <p>Chen, C.W.Y. (2011). Evaluating one's own oral academic presentation: A method to assist graduate students' academic discourse socialization. <i>The Asian ESP Journal</i>, 7(3), 5-28.</p> <p>Hu, G. & Liu, Y. (2018). Three minute thesis presentations as an academic genre: A cross-disciplinary study of genre moves. <i>Journal of English for Academic Purposes</i>, 35, 16-30.</p> <p>Lantsoght, E. O. (2022). Effectiveness of doctoral defence preparation methods. <i>Education Sciences</i>, 12(7), 473.</p> <p>Roberts, C.M. (2010). <i>The dissertation journey: A practical and comprehensive guide to planning, writing, and defending your dissertation</i> (2nd ed.). Corwin Press.</p>					

	<p><u>Online Videos:</u></p> <p>University of Melbourne (2015, Mar 11). <i>Academic skills: Presenting effectively Part 1-5 things you should know about presenting and organizing your talk.</i> https://www.youtube.com/watch?v=qFLL-XB56UU</p> <p>University of Melbourne (2015, Mar 11). <i>Academic skills: Presenting effectively Part 2 – Engaging the audience.</i> https://www.youtube.com/watch?v=lo9xOV6WUqM</p> <p>University of Melbourne (2015, Mar 11). <i>Academic skills: Presenting effectively Part 3 – Effective visuals and PowerPoint slides:</i> https://www.youtube.com/watch?v=O-D9fZN01yk</p> <p><u>Selected Websites</u></p> <p>Hayward, A. (2017). <i>9 Tips for presenting at an academic conference.</i> https://www.editage.com/insights/9-tips-for-presenting-at-an-academic-conference</p> <p>Lakdawalla, E. (2018). <i>Speak your science: How to give a better conference talk.</i> http://www.planetary.org/blogs/emily-lakdawalla/2018/0206-speak-your-science.html</p> <p>Lindgren, N. (2024). <i>A Beginners Guide to Speaking at Conferences.</i> https://nicolalindgren.com/a-beginners-guide-to-speaking-at-conferences/</p>
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Subject Description Form

Subject Code	ELC6012
Subject Title	Thesis Writing for Research Students
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	ELC6011
Objectives	This subject aims to improve research students' academic writing proficiency, enhance their understanding of the academic audience, develop their awareness of academic conventions, and develop their skills in using clear, appropriate, persuasive, and analytical language in thesis writing.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to present their research effectively in a thesis through:</p> <ol style="list-style-type: none"> presenting the study clearly, appropriately and concisely in the Abstract; introducing the background, rationale and aim of the study in the Introduction analytically; reviewing the literature critically; analysing the appropriateness of the methodology used in the study; reporting and discussing the findings of the study logically and systematically; and discussing the significance of the study in the Conclusion in a clear and succinct manner. <p>To achieve the above outcomes, students are expected to use language, text structures, and cohesive devices appropriate to the academic audience, select and present information analytically, concisely and appropriately, examine and cite sources critically, and analyse the impact and significance of the research persuasively.</p>
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> Critical analysis of prior research Understanding research thesis writing process and the structure of a thesis; identifying language features of thesis writing. Awareness of academic conventions Developing awareness of citation practices, referencing format and language use adopted in the related disciplines. Inter and intra paragraphing connections Using effective cohesive devices to plan, organize and connect different parts of a research thesis.

	<p>4. Clear appropriate, persuasive and analytical language use Summarising, evaluating and citing sources; describing and discussing research data; objectively evaluating research contribution; writing, revising and proofreading written texts.</p>																																														
Teaching / Learning Methodology	<p>The study method is primarily seminar-based. Activities include teacher input as well as individual and group work involving writing practice, evaluation of texts, mini-presentations and discussions. Practical work will involve analysing texts such as journal articles and research theses that are relevant to students' research areas. Students will be provided with opportunities to apply the language skills acquired to the preparation of their own thesis. Students will be referred to information on the Internet and the ELC's Centre for Independent Language Learning.</p> <p>Learning materials developed by the English Language Centre are used throughout this course. Additional reference materials will be recommended as required.</p>																																														
Assessment Methods	<table><tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="6">Intended subject learning outcomes to be assessed</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th></tr><tr><td>1. Writing an introduction for a research study (draft)</td><td>20%</td><td></td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr><tr><td>2. Writing an introduction for a research study (final)</td><td>30%</td><td></td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr><tr><td>3. Developing an e-Portfolio for thesis writing</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>Total</td><td>100%</td><td colspan="6"></td></tr></table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Assessments 1 and 2 assess students' abilities to write an effective introduction for their own research study. The assessments require that students introduce the background, rationale and objectives of their research, review the literature and establish the niche in their research area, and describe the methods used in their study to occupy the niche (ref. LOs (b) , (c) and (d)).</p> <p>Assessments 3 requires that students collect learning materials that are conducive to their writing-up of a research thesis, and provide annotated thesis excerpts to illustrate their understanding of the structure and language use specific to a research thesis (ref. LOs (a) to (f)).</p> <p>In addition to the three assessments, students are required to complete further language training through out-of-class collocation practice, short in-class writing tasks and language practices in the course handouts.</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						a	b	c	d	e	f	1. Writing an introduction for a research study (draft)	20%		✓	✓	✓			2. Writing an introduction for a research study (final)	30%		✓	✓	✓			3. Developing an e-Portfolio for thesis writing	50%	✓	✓	✓	✓	✓	✓	Total	100%						
Specific assessment methods/tasks	% weighting			Intended subject learning outcomes to be assessed																																											
		a	b	c	d	e	f																																								
1. Writing an introduction for a research study (draft)	20%		✓	✓	✓																																										
2. Writing an introduction for a research study (final)	30%		✓	✓	✓																																										
3. Developing an e-Portfolio for thesis writing	50%	✓	✓	✓	✓	✓	✓																																								
Total	100%																																														

Student Study Effort Expected	Class contact:	
	▪ Seminars	39 Hrs.
	Other student study effort:	
	▪ Self-study and preparation for assessments	78 Hrs.
	Total student study effort	117 Hrs.
Reading List and References	<p><u>Course materials</u> Learning materials developed by the English Language Centre</p> <p><u>Recommended references</u> Blair, L. (2016). <i>Writing a graduate thesis or dissertation</i>. Sense Publishers.</p> <p>Calabrese, R.L. (2006). <i>The elements of an effective dissertation and thesis: a step-by-step guide to getting it right the first time</i>. Lanham, MD: Rowman & Littlefield.</p> <p>Cooley, L. and Lewkowicz, J. (2003). <i>Dissertation writing in practice: Turning ideas into text</i>. Hong Kong: Hong Kong University Press.</p> <p>Cooksey, R. W., & McDonald, G. (2019). <i>Surviving and thriving in postgraduate research</i> (Second edition). Singapore: Springer Singapore.</p> <p>Dunleavy, P. (2011). <i>Authoring a PhD: How to plan, draft, write, and finish a doctoral thesis or dissertation</i>. Palgrave Macmillan.</p> <p>Golden-Biddle, K. & Locke, K. (2007). <i>Composing qualitative research. (Second Edition)</i>. Sage Publications.</p> <p>Feak, C. B., & Swales, J. M. (2009). <i>Telling a research story: Writing a literature review</i>. University of Michigan Press.</p> <p>Felix, M. S., & Smith, I. (2019). <i>A practical guide to dissertation and thesis writing</i>. UK: Cambridge Scholars Publishing.</p> <p>Foss, S.K. (2015). <i>Destination dissertation: a traveller's guide to a done dissertation / (Second Edition)</i>. UK: Rowman & Littlefield Publishers.</p> <p>Hammond, M. (2023). <i>Writing a postgraduate thesis or dissertation: tools for success</i>. Routledge.</p> <p>Kornuta, H.M., & Germaine, R. W. (2019). <i>A concise guide to writing a thesis or dissertation: Educational research and beyond (Second edition)</i>. Abingdon, Oxon: Routledge.</p> <p>Lantsoght, Eva O. L. (2018). <i>The a-Z of the PhD Trajectory</i>. Springer International Publishing AG.</p> <p>Luey, Beth. (2007). <i>Revising your dissertation</i> (2nd ed.). University of California Press.</p> <p>Lunenburg, F.C. & Irby, B.J. (2008). <i>Writing a successful thesis or dissertation:</i></p>	

	<p><i>tips and strategies for students in the social and behavioural sciences</i>. Corwin.</p> <p>Oliver, P. (2013). <i>Writing your thesis (Third Edition)</i>. London: Sage.</p> <p>OSiochru, C. (2023). <i>Student guide to writing research reports, papers, theses and dissertations</i>. Routledge. https://doi.org/10.4324/9781003107965</p> <p>Paltridge, B., & Starfield, S. (2020). <i>Thesis and dissertation writing in a second language: a handbook for students and their supervisors (Second edition)</i>. Abingdon, Oxon: Routledge.</p> <p>Perkins, M., & Roe, J. (2024). Academic publisher guidelines on AI usage: A ChatGPT supported thematic analysis <i>F1000Research</i>, 12:1398 https://doi.org/10.12688/f1000research.142411.2</p> <p>Swales, J.M. & Feak, C.B. (2012). <i>Academic writing for graduate students: Essential tasks and skills (Third Edition)</i>. Ann Arbor, MI: University of Michigan Press.</p> <p>Wallwork, A. (2024). <i>AI-Assisted Writing and Presenting in English</i> (1st ed. 2024). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-48147-5</p>
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Subject Description Form

Subject Code	ENGL6016
Subject Title	Advanced Academic English for Research Students: Publishing and Presenting
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	None
Objectives	The objective of the subject is to enable research postgraduate students to publish successfully in international journals and deliver effective conference presentations. This is achieved by equipping students with the essential English language skills and linguistic knowledge to effectively communicate the background, rationale, findings, and significance of their research. Students will be guided systematically to (1) improve their academic English; (2) acquire and apply knowledge of the generic and linguistic features of conference presentations and research articles; and (3) increase the persuasiveness of their spoken and written discourse. The primary focus will be on writing research articles.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> a. Be familiar with the differences between spoken and written academic English; b. Analyze and apply generic structures and linguistic features in research writing; c. Write research articles in clear, accurate and appropriate English; d. Prepare articles for publication in light of comments from editors and reviewers; e. Structure and deliver clear and persuasive presentations in English.
Subject Synopsis / Indicative Syllabus	Part 1 – Publishing in international journals: (2/3) <ul style="list-style-type: none"> ▪ Interacting with readers; ▪ Writing effective introductions and literature reviews; ▪ Describing research methods; ▪ Discussing the implications and significance of the findings; ▪ Drawing conclusions; ▪ Writing abstracts; and ▪ Addressing editors' and reviewers' comments.

	Part 2 – Delivering an effective conference presentation: (1/3) <ul style="list-style-type: none">▪ Structuring and delivering conference presentations in clear and appropriate academic English;▪ Interacting with an audience and responding to questions.						
Teaching / Learning Methodology	A learner-centered and highly interactive mode of teaching will be adopted. Students will engage in activities where they can share their experience and concerns, put forth their own thinking and comment on each other's research ideas, and critique each other's academic writings. Students will be encouraged and guided to discover for themselves the various linguistic and generic features of successful presentations and academic writing through intellectually challenging tasks.						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c	d	e
	1. Individual presentation	30%	✓	✓	✓		
	2. Term paper	50%			✓	✓	✓
	3. Class participation	20%	✓	✓	✓	✓	✓
	Total	100%					
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: <u>Individual presentation</u> Students will prepare a 15-minute conference presentation in which they demonstrate their ability to use appropriate academic English and engage effectively with the audience. <u>Term paper</u> This assignment requires students to critique a research article to demonstrate their knowledge of the generic and linguistic features of research articles. Their ability to present ideas and arguments coherently and persuasively using appropriate academic English will also be assessed. The term paper could be in the form of a research article from the student's field. <u>Class participation</u> Student's active participation and engagement with the learning activities will be part of the assessment of the subject.						

Student Study Effort Expected	Class contact:	
	▪ Interactive lectures	39 Hrs.
	▪	Hrs.
	Other student study effort:	
	▪ Reading	42 Hrs.
	▪ Preparation for assignments	30 Hrs.
	Total student study effort	111 Hrs.
Reading List and References	<p>Hyland, K. (2006). English for Academic Purposes: An Advanced Resource Book. Oxon; New York: Routledge.</p> <p>Jalongo, M., and Machado, C. (2016). Making effective presentations at professional conferences: a guide for teachers, graduate students and professors. Cham: Springer.</p> <p>Kline, J.A. (2004). Speaking Effectively: Achieving Excellence in Presentations, Upper Saddle River, N.J.: Pearson/Prentice Hall.</p> <p>Reinhart, S.M. (2002). Giving Academic Presentations, Ann Arbor, Michigan: University of Michigan Press.</p> <p>Strunk, W. & White, E.B. (2000) The Elements of Style, New York: Pearson.</p> <p>Swales, J. & Christine, F. (2012). Academic writing for graduate students: Essentials tasks and skill (3rd ed.) Ann Arbor: University of Michigan.</p> <p>Wallace, M. & Wray, A. (2011). Critical Reading and Writing for Postgraduates. London; California; New Delhi; Singapore: SAGE.</p>	

Subject Description Form

Subject Code	AF/LGT/MM5R01
Subject Title	Academic Integrity and Ethics in Business
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	None
Objectives	<ol style="list-style-type: none"> 1. Raise students' awareness of the importance of adhering high standards of academic integrity in business studies 2. Enhance students' ability to critically analyse ethical issues in business and make appropriate ethical decisions.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> 1. Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. 2. Demonstrate awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. 3. Recognise important ethical issues and practices in a university context. 4. Understand the implications and concerns on academic integrity raised by the latest technology, such as ChatGPT and other Generative Artificial Intelligence (GenAI) tools. 5. Identify and deal with complex ethical and professional issues in business settings, and be able to communicate effectively the issues to the stakeholders and the public.
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> 1. What academic integrity is and why it is important 2. Academic integrity raised by the latest technology 3. The need for ethics training and the meaning of ethical behavior 4. Philosophy and codes of ethics and their origins 5. Culture, religion and the law – how these relate to ethical codes of conduct 6. Obtaining ethical approval for a research project (where appropriate): procedures and processes 7. Ethics in business 8. Recent ethical issues affecting Hong Kong and the society in general 9. Ethical use of information in thesis or assignment writing: understanding copyright, plagiarism and proper citation
Teaching / Learning Methodology	Lecture/seminar/workshop; or case teaching approach

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						
			1	2	3	4	5		
	1. Written assignment on business scenario/ case study analysis/ essay	60%	✓	✓	✓	✓			
	2. Oral presentation	25%	✓	✓			✓		
	3. Attendance and class participation	15%			✓				
	Total	100%							
	<i>To pass this subject, students are required to obtain Pass in the overall subject grade.</i>								
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:								
	<div>1. Business scenario/case study analysis/essay will assess ability to identify and analyze academic integrity and ethical issues in business and to present a coherent and detailed critique and plan on how these could be avoided or resolved (giving sources and written work accompanied by a Turnitin Report). The assignment will assess the student’s ability to identify, discuss and analyze academic integrity and ethical principles and issues from a wide perspective, and evaluate how individual, professions and societies benefit from following ethically acceptable behavior and practices.</div> <div>2. Oral presentation will assess the students’ ability to present and argue the points in support of their rationale.</div> <div>3. The attendance and class participation will ensure students are present in class to absorb the core principles and concepts of the course.</div>								
Student Study Effort Expected	Class contact:								
	▪ Lecture/seminar/workshop/oral presentation						13 Hrs.		
	Other student study effort:								
	▪ Self-study and group work						13 Hrs.		
	▪ Assignment preparation						13 Hrs.		
Reading List and References	Total student study effort								39 Hrs.
	Articles: Fanelli, D. (2009). How many scientists fabricate and falsify research? A systematic review and meta-analysis of survey data. PloS one, 4(5), e5738. John, L.K., Loewenstein, G., & Prelec, D. (2012). Measuring the prevalence of questionable research practices with incentives for truth telling. Psychological science, 23(5), 524-532.								

	<p>Lund, B.D., Wang, T., Mannuru, N.R., Nie, B., Shimray, S., & Wang, Z. (2023). ChatGPT and a new academic reality: Artificial Intelligence-written research papers and the ethics of the large language models in scholarly publishing. <i>Journal of the Association for Information Science and Technology</i>, 74(5), 570-581.</p> <p>Swazey, J.P., Anderson, M.S., Lewis, K.S., & Louis, K.S. (1993). Ethical problems in academic research. <i>American Scientist</i>, 81(6), 542-553.</p> <p>Tsui, A.S., & McKiernan, P. (2022). Understanding scientific freedom and scientific responsibility in business and management research. <i>Journal of Management Studies</i>, 59(6), 1604-1627.</p> <p>Websites:</p> <p>International Center for Academic Integrity (ICAI). (2021). <i>The Fundamental Values of Academic Integrity</i>. (3rd ed.). https://academicintegrity.org/images/pdfs/20019_ICAI-Fundamental-Values_R12.pdf</p> <p>Northwestern University Principles Reading Academic Integrity https://www.northwestern.edu/provost/policies-procedures/academic-integrity/principles.html</p> <p>University of Oxford Academic Integrity in Research https://hr.admin.ox.ac.uk/academic-integrity-in-research</p> <p>Hong Kong Polytechnic University Student Guide on Academic Integrity: https://www.polyu.edu.hk/ous/docdrive/Academic_Integrity/Student_Guide.pdf</p> <p>Hong Kong Polytechnic University Pao Yue-Kong Library guide on Academic Integrity: https://www.lib.polyu.edu.hk/research-support/academic-integrity</p> <p>Hong Kong Polytechnic University Educational Development Center: Generative AI https://teaching.cornell.edu/generative-artificial-intelligence/aiacademic-integrity</p> <p>Hong Kong Polytechnic University Educational Guidelines for Students on the Use of Generative Artificial Intelligence (GenAI): https://www.polyu.edu.hk/ar/students-in-taught-programmes/use-of-genai/</p> <p>Materials from the Hong Kong Business Ethics Development Centre website: https://hkbedc.icac.hk/en</p> <p>Materials from Ethics Web.ca: http://www.ethicsweb.ca/resources/professional/issues.html</p> <p>Retraction Watch: https://retractionwatch.com/</p>
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Subject Description Form

Subject Code	HTM5R02
Subject Title	Academic Integrity and Ethics in Business Studies and Research
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	None
Objectives	<ol style="list-style-type: none"> 1. To raise students' awareness of the importance of adhering to high standards of academic integrity. 2. To enhance students' ability to critically analyse ethical issues and make appropriate ethical decisions.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. b. Enhance awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. c. Recognise important ethical issues and practices in a university context. d. Understand the implications and concerns on academic integrity raised by the latest technology such as ChatGPT and other Generative Artificial Intelligence tools. e. Identify and deal with complex ethical and professional issues in discipline-specific settings, such as the use of confidential/sensitive company data, the use of animals for or the involvement of children and vulnerable adults in business research undertakings, and be able to communicate effectively on academic integrity and ethics issues to the concerned stakeholders and the general public.
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> 1. Definition and essence of academic integrity, and the philosophies, origins, and codes of ethics in social sciences research in general and in business research in particular. 2. The need for understanding and learning about business research ethics and the meaning of ethical behaviour in business research: Case studies, examples of ethical misbehaviours, instances of (self) plagiarism and retraction of published work, amongst other cases of academic integrity and ethics in business research. 3. The culture, politics and law(s) pertaining to ethical behaviour in business research and practice. 4. Mechanism and procedures in obtaining ethical approval for a business research

	<p>project.</p> <ol style="list-style-type: none"> 5. Ethics in businesses and industries: Common issues, guiding principles, and scenarios in business research. 6. Ethics and human behaviour: Individual, professional and societal responsibilities of business research. 7. Involving animals, children, minorities and other vulnerable people in tourism, recreation and other business research, as well as using confidential/sensitive company data for research. 8. Recent ethical issues affecting social economic development in Hong Kong 9. Ethical use of information and information technology in postgraduate studies and research; Understanding copyright, plagiarism and proper citations, and using ChatGPT for business research.
Teaching / Learning Methodology	<p>This subject, in a one-hour weekly meeting mode, will consist of lectures, seminars, discussions, presentations, self-reflections, and other learning activities (as outlined below).</p> <ul style="list-style-type: none"> • Interactive lectures – To explain concepts and theories with examples drawn from business research and practice. Learners are encouraged to raise issues for discussion in the classroom. • Discussions – To facilitate critical thinking on academic integrity and ethics in business research. • Seminars via guest speakers – Depending on availability, guest speakers may be invited to share their perspectives on research involving animals, children, minorities and other vulnerable people, as well as the use of confidential/sensitive company data in tourism, recreation and other business contexts. • Presentations – Learners will be requested, either individually or as a group, to present for example on issues relating to academic integrity and ethics in their own business-oriented research. • Self-reflections – Learners are encouraged to reflect on their own experience and liberal/intellectual growth relating to academic integrity and ethics in business research. <p>To achieve the subject's objectives and learning outcomes, learners are expected to</p> <ul style="list-style-type: none"> • Attend and positively participate in class lectures, seminars, discussions and other learning activities. • Prepare for class by completing required readings and other assignments on time. • Engage in discussions and share in the learning process with fellow classmates, the instructor, and guest speakers (if any). • Avoid disruptions and distractions (e.g., no conversing while others are speaking, no using/playing smartphones in class). • Respect diversity and positively nurture a community of learning and practice in class.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d	e	
	1. Group assignment on discipline-specific scenario/ case study analysis	40%	✓	✓	✓	✓	✓	
	2. Individual assessment (1,000-word essay on a topic relating to academic integrity and ethics in business research)	30%	✓	✓	✓	✓	✓	
	3. Oral presentation	20%	✓	✓	✓	✓	✓	
	4. Attendance/class discussions	10%		✓	✓	✓		
	Total	100%						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Notably, the intended learning outcomes of this subject focus on conceptual understandings of academic integrity and ethics in business research, as well as on the instrumental and process use of such knowledge in business research practice. The specified assessment methods/tasks serve exactly these outcomes, through analysing, discussing speaking on and writing about issues on academic integrity and ethics in business research. Thus, with the above four specified assessments, the five intended learning outcomes will have been adequately achieved. Subject assessment will be graded on a pass/fail basis (where a total score ≥ 60 is pass , and a total score ≤ 59 is fail).							
Student Study Effort Expected	Class contact:							
	▪ Lecture/seminar/workshop/oral presentation							13 Hrs.
	Other student study effort:							
	▪ Self study and group work							17 Hrs.
	▪ Preparation for assignments and preparations							10 Hrs.
	Total student study effort							40 Hrs.
Reading List and References	1. Cassell, C., Cunliffe, A., Grandy, G. (2018, eds.). <i>The SAGE Handbook of Qualitative Business and Management Research Methods</i> . Thousand Oaks: Sage. 2. Denzin, N., & Lincoln, Y. (2018, eds.). <i>The SAGE Handbook of Qualitative Research</i> . Thousand Oaks: Sage.							

	<ol style="list-style-type: none"> 3. Frechtling, D. (2018). On the ethics of tourism research. <i>Journal of Travel Research</i>, 57(8), 1054-1067. 4. Hong Kong Business Ethics Development Centre (2023). Mission About Us Hong Kong Business Ethics Development Centre (icac.hk) 5. UNWTO (1999). Global Code of Ethics for Tourism https://www.unwto.org/global-code-of-ethics-for-tourism
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Subject Description Form

Subject Code	EEE5R03
Subject Title	Engineering Ethics and Academic Integrity
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>The objectives of the subject are to:</p> <ol style="list-style-type: none"> 1. Raise students' awareness of the importance of adhering to high standards of academic integrity. 2. Enhance students' ability to critically analyse ethical issues and make appropriate ethical decisions.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> 1. Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. 2. Demonstrate awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. 3. Recognise important ethical issues and practices in a university context. 4. Understand the implications and concerns on academic integrity raised by the latest technology, such as ChatGPT and other Generative Artificial Intelligence (GenAI) tools. 5. Identify and deal with complex ethical and professional issues in discipline-specific settings, and be able to communicate effectively the issues to the stakeholders and the public. 6. Critically analyse and discuss problem cases related to engineering ethics and academic integrity.
Subject Synopsis / Indicative Syllabus	<p><u>Keyword Syllabus</u></p> <ul style="list-style-type: none"> • Introduction to engineering and research ethics – Needs for research ethics to the integrity and well-being of industry, professions, and community; overview of theories and methods in engineering and research ethics. • Ethical issues related to project collaboration, publication, and authorship – Responsibility for quality works; credit and responsibility of project collaborators; citation and acknowledgement; qualifications for authorship; engineering case studies. • Professional and research misconduct – Definition of professional and research misconduct; self-deception in misconduct; factors that undermine integrity; understanding and fostering responsible conduct; engineering case studies.

	<ul style="list-style-type: none">• Involving human subjects and animals – The common rule for the protection of human subjects in research and professional functions; responsibility for experimental animals; requirements governing research and professional functions involving human subjects and animals; engineering case studies.• Rights and responsibilities regarding intellectual property – Individual credit and the ownership of innovation; copyrights, “Fair Use”, and the Digital Millennium Copyright Act; patents and trade secrets; property rights contrasted with credit for invention; patenting of inventions contrasted with publication of project result; engineering case studies.• Cyber ethics – Common threats to information and systems in the cyberspace; core values of cybersecurity: privacy, security, fairness, and accountability; potential value conflicts and solutions; ethical hacking and concerns; legislative framework: EU Data Protection Regulation; engineering case studies.• Ethical use of Generative AI – AI ethics; introduction of Generative AI and its ethical considerations in engineering research and professional functions; AI hallucination; technical efforts in fake, bias, and plagiarism identification; ethical responsibility of developers using generative AI; regulating generative AI and the AI Act; engineering case studies.																																														
Teaching / Learning Methodology	<ul style="list-style-type: none">• Lectures: Formal classroom lectures will be given to introduce the concepts of engineering research ethics. Core principles of ethics will be illustrated with engineering cases. They support the intended learning outcomes 1 to 5. Since all lectures are important, <u>students need to achieve 100% attendance in the lectures to pass the subject.</u>• Group discussions and quizzes: During the lecture, students will form groups to analyse and discuss various engineering ethics cases related to the topic of the lecture. Students also need to complete an online quiz after the lecture to show their understanding of the teaching material. They support the intended learning outcomes 1 to 6.• Case study and reflection: Students need to choose one of the problem cases in engineering ethics and academic integrity for in-depth analysis. The analysis result will be shared with other students in a presentation session. Students also need to analyse an ethical problem related to their research project/field of professional work for the reflective study. They support the intended learning outcomes 1 to 6.																																														
Assessment Methods in Alignment with Intended Learning Outcomes	<p>This subject will be assessed on a pass/fail grading system and will not be included in the GPA calculation. To pass the subject, students need to attend all lectures and score 50% or higher in the total marks.</p> <table><tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="6">Intended subject learning outcomes to be assessed</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr><tr><td>1. Quizzes</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr><tr><td>2. Case study - Presentation</td><td>40%</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr><tr><td>3. Reflective writing</td><td>40%</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr><tr><td>Total</td><td>100%</td><td colspan="6"></td></tr></table>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						1	2	3	4	5	6	1. Quizzes	20%	✓	✓	✓	✓	✓		2. Case study - Presentation	40%	✓				✓	✓	3. Reflective writing	40%	✓				✓	✓	Total	100%						
Specific assessment methods/tasks	% weighting			Intended subject learning outcomes to be assessed																																											
		1	2	3	4	5	6																																								
1. Quizzes	20%	✓	✓	✓	✓	✓																																									
2. Case study - Presentation	40%	✓				✓	✓																																								
3. Reflective writing	40%	✓				✓	✓																																								
Total	100%																																														

	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Quizzes: Students will complete an online quiz after each lecture to show their understanding of the teaching materials. They assess the intended learning outcomes 1 to 5.</p> <p>Case study presentation: The best way to learn engineering ethics and academic integrity is to analyse previous problem cases so that students can learn the lessons from them. A presentation session will be arranged for students to share with other students their analysis results. It assesses the intended learning outcomes 1, 5 and 6.</p> <p>Reflective writing: To assist students to sink in the discussion in the classes, they are required to submit a reflective report to detail their analysis of an ethical problem related to their research project/field of professional work. It assesses the intended learning outcomes 1, 5, and 6. The reflective writing assignment submissions will be marked by students' supervisors adopting a holistic approach.</p>	
Student Study Effort Expected	Class contact:	
	▪ Lecture and class activity	13 Hrs.
	Other student study effort:	
	▪ Self-study and group work	12 Hrs.
	▪ Assignment preparation	10 Hrs.
	Total student study effort	35 Hrs.
Reading List and References	<ol style="list-style-type: none"> 1. Caroline Whitbeck (2011). <i>Ethics in Engineering Practice and Research</i>, Cambridge University Press. 2. Lance Eliot (2023). <i>Generative AI ChatGPT And AI Ethics</i>, Lance B. Eliot. 3. Markus Christen, Bert Gordijn, and Michele Loi (2020). <i>The Ethics of Cybersecurity</i>, Cham: Springer. 4. Kristin Shrader-Frechette (1994). <i>Ethics of Scientific Research</i>, Lanham, Md.: Rowman & Littlefield. 5. University of California, San Diego (UC San Diego). <i>Resources for Research Ethics Education</i>, http://research-ethics.net. 	

Subject Description Form

Subject Code	HTI5R04
Subject Title	Academic Integrity and Ethics (Health and Social Sciences)
Discipline	Health & Social Science
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	None
Objectives	<ul style="list-style-type: none"> To equip students with a deep appreciation of professional integrity, ethical guidelines, and codes of conduct that they can apply in their research studies at PolyU and in their future professional and personal lives.
Intended Learning Outcomes	<p>On successful completion of this subject, students will be able to:</p> <ol style="list-style-type: none"> Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. Demonstrate awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. Recognise important ethical issues and practices in a university context. Understand the implications and concerns on academic integrity raised by the latest technology, such as ChatGPT and other Generative Artificial Intelligence (GenAI) tools. Identify and deal with complex ethical and professional issues in discipline-specific settings, and be able to communicate effectively the issues to the stakeholders and the public. Understand, discuss, and apply ethical principles and codes across a range of healthcare and social science related disciplines and scenarios.
Subject Synopsis / Indicative Syllabus	<ul style="list-style-type: none"> The needs for ethics training and the understanding of ethical behaviour in research: case studies, disasters, and learning by the mistakes of others. Philosophy and codes of ethics and their origins. Culture, religion, the law and new technology development (e.g., in the area of artificial intelligence) – how these relate to ethical codes of conduct. Obtaining ethical approval for a research project: procedures and processes. Ethics in life science, humanities, education, business, and industry (e.g., patient care): common issues, guiding principles, discipline-specific scenarios. Ethics in health and social science: common issues in and guiding principles for <ul style="list-style-type: none"> medical or behavioural studies through social media, electronic devices, or ChatGPT-types of APPs; inclusion of social and/or economic vulnerable populations (e.g., children

	and elderly) in medical and behavioural research; <ul style="list-style-type: none">○ use of animal models for medical research. <ul style="list-style-type: none">• Ethics and human behaviour: individual, professional, and societal responsibilities.• Recent ethical issues affecting Hong Kong and society in general.• Ethical use of information in thesis writing: understanding copyright, plagiarism, and proper citation							
Teaching / Learning Methodology	A hybrid mode of learning combining lectures, seminars, workshops, group studies and course projects. It includes an initial set of mandatory lectures on the basic concepts, histories, theories and principles of ethics, followed by lectures and seminars with various case studies, group discussions and student course project presentations.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			1	2	3	4	5	6
	1. In-class quizzes	40%	✓	✓	✓			✓
	2. Group assignment on discipline-specific scenario/case study analysis	40%	✓		✓			✓
	3. Oral presentation	10%				✓	✓	✓
	4. Attendance	10%	✓	✓	✓	✓	✓	✓
	Total	100%						
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: <ol style="list-style-type: none">1. Individually graded in-class quizzes will assess the mastery of the basic concepts and guiding principles of ethics as well as the ability of applying them to specific situations in medicine and social science and the ability of dealing with intellectual properties, copyrights, citations in theses and research papers.2. Discipline-specific scenario/case study analysis will assess the ability to identify and analyse ethical issues in the student's own discipline and to present a coherent and detailed critique and plan on how these could be avoided or resolved (giving sources and written work accompanied by a Turn-it-in Report). The group assignment will assess the student's ability to identify, discuss and analyse ethical principles and issues from a wide perspective and evaluate how individuals, professions, and societies benefit from following ethically acceptable behaviour and practices.3. Oral presentations will assess the students' ability to present and argue points in support of their rationale.4. Attendance is required to support the hybrid mode of teaching, particularly group studies and group course projects.5. Performance is assessed through individually graded quizzes and group studies and projects. The final pass/fail grade will be based on the numerical sources computed based on the metrics in the table above.								

Student Study Effort Expected	Class contact:	
	▪ Lecture/seminar/workshop	13 Hrs.
	Other student study effort:	
	▪ Oral presentation	5 Hrs.
	▪ Self-study and group work	12 Hrs.
	▪ Assignment preparation	10 Hrs.
	Total student study effort	40 Hrs.
Reading List and References	<p>Guy, M.E., (1990). <i>Ethical Decision Making in Everyday Work Situations</i>, Bloomsbury Academic.</p> <p>Liautaud, S. and Sweetingham, L., (2021) <i>The Power of Ethics: How to make good choices in a complicated world</i>, Simon & Schuster.</p> <p>Liao, S. M., (2020) <i>Ethics of Artificial Intelligence</i>, Oxford University Press.</p> <p>van der Burg, S. and Swierstra, T., (2013) <i>Ethics on the Laboratory Floor</i>, Palgrave Macmillan.</p> <p>Singer, P., (2011) <i>Practical Ethics</i>, Cambridge University Press.</p> <p>Materials from the Hong Kong Ethics development website (http://www.icac.org.hk/hkedc/eng/library2.asp)</p> <p>Materials from EthicsWeb.ca (http://www.ethicsweb.ca/resources/professional/issues.html)</p> <p>Selected readings and videos</p> <p>Declaration of Helsinki (revised 2008)</p>	

Subject Description Form

Subject Code	CBS5R05
Subject Title	Professional Ethics and Academic Integrity
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>The objectives of the subject are to:</p> <ol style="list-style-type: none"> 1. Raise students' awareness of the importance of adhering high standards of academic integrity 2. Enhance students' ability to critically analyse ethical issues and make appropriate ethical decisions.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> 1. Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. 2. Demonstrate awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. 3. Recognise important ethical issues and practices in a university context. 4. Understand the implications and concerns on academic integrity raised by the latest technology, such as ChatGPT and other Generative Artificial Intelligence (GenAI) tools. 5. Identify and deal with complex ethical and professional issues in discipline-specific settings, and be able to communicate effectively the issues to the stakeholders and the public.
Subject Synopsis / Indicative Syllabus	<ul style="list-style-type: none"> • Introduction to moral theory; Philosophy and codes of ethics and their origins • Applying ethics to different linguistic communities and language policy advising; Ethics in recruiting human subjects (including children and vulnerable adults), working with consultants, experimental designs and conducting experiments on human subjects for linguistic research • Ethics in linguistic fieldwork and analysis; authorship and data ownership; copyright; data management • Ethics in translation research and practice: common issues, guiding principles, discipline-specific scenarios • Ethics in research conducted in various professional settings such as classrooms, health-related contexts and media • Obtaining ethical approval for a research project: procedures and processes • Ethics and human behavior: individual, professional, and societal responsibilities • Guidelines in using GenAI tools • Academic integrity: avoiding plagiarism

Teaching / Learning Methodology	Lectures: introduce students to fundamental principles and theories of ethics in research; examine case studies and examples to illustrate ethical dilemmas that researchers may encounter during their research; lead students to discuss topics such as informed consent, confidentiality of data, recruitment of human subjects, and the responsible use of data. Seminars: encourage students to practice the procedure in obtaining human subjects ethics approval; encourage students to reflect on the ethical dimensions of research and critically evaluate decisions made in case studies; lead students to raise questions and discuss contents of case studies presented by peer students; encourage students to debate on topics related to ethics.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			1	2	3	4	5	
	1. Tests	60%	✓	✓	✓	✓	✓	
	2. Oral presentation	25%					✓	
	3. Attendance	15%	✓	✓	✓	✓		
	Total	100%						
The subject is assessed on a Pass/Fail grading mechanism. The attendance includes scores of in-class quizzes, which assess the learning outcomes. Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: 1. Two tests will evaluate students’ knowledge of human ethics and academic integrity and their ability to identify and analyze ethical issues in their study and research. They will assess students’ ability to identify, discuss and analyze ethical principles and issues, and evaluate how individuals, professions, and societies benefit from following ethically acceptable behavior and practices. 2. One oral presentation will assess the students’ ability to present and argue points in support of their rationale.								
Student Study Effort Expected	Class contact:							
	▪ Lecture/seminar/workshop							13 Hrs.
	Other student study effort:							
	▪ Self-study and group work							27.5 Hrs.
	Total student study effort							40.5 Hrs.
Reading List and References	1. De Costa, P. I. (2015). <i>Ethics in applied linguistics research: Language researcher narratives</i> . Routledge. 2. Koskinen, K., & Pokorn, N.K. (2020). <i>The Routledge handbook of translation and ethics</i> . Routledge. 3. Inghilleri, M. (2013). <i>Interpreting justice: Ethics, politics and language</i> . Routledge. 4. Hong Kong Business Ethics Development Centre. (n.d.). https://hkbedc.icaui.hk/en 5. The Hong Kong Polytechnic University. (2023). <i>Guidelines for Students on the Use of Generative Artificial Intelligence (GenAI): Effective from 2022/23 Summer Term</i> . https://www.polyu.edu.hk/en/ar/students-in-taught-programmes/use-of-genai/							

Subject Description Form

Subject Code	CHC5R06
Subject Title	Academic Integrity and Ethics in China-related Humanities
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	None
Objectives	To equip students with a deep appreciation of ethical guidelines and codes of conduct that they can apply in their research studies at PolyU and in their future professional and personal lives.
Intended Learning Outcomes	<p>On completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. Demonstrate awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. Recognise important ethical issues and practices in a university context. Understand the implications and concerns on academic integrity raised by the latest technology, such as ChatGPT and other Generative Artificial Intelligence (GenAI) tools. Identify and deal with complex ethical and professional issues in discipline-specific settings, and be able to communicate effectively the issues to the stakeholders and the public.
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> The need for ethics training and the meaning of ethical behavior in research, fieldwork, data and artifact collection, interviews, and written work Codes of ethics and their origins Obtaining ethical approval for a research project: procedures and processes Ethics in the humanities: issues, principles, and case studies Understanding copyright, plagiarism and proper citation in term papers, presentations, and theses Introduction to types of AI used in the humanities and their appropriate uses Understanding abuses of AI in plagiarism and presenting inaccurate or biased facts and interpretations Ethics and human behavior: individual, professional and societal responsibilities
Teaching / Learning Methodology	<p>Like most other RPg subjects in the humanities disciplines, the primary teaching/learning methods will include the following:</p> <ol style="list-style-type: none"> Self-study: Students will be required to complete the weekly reading

	assignments before each class session; 2. Lecture: Instructors can choose to use part of the class session to deliver a short lecture on the topic that will be discussed in that session; 3. Discussion and presentation: At least half of the class contact time should be used for discussions and presentations on the weekly topics.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			1	2	3	4	5	
	1. Group assignment and oral presentations	60%		✓	✓	✓		
	2. Written exam	25%		✓	✓	✓	✓	
	3. Attendance and participation	15%	✓				✓	
	Total	100%						
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The group assignment and oral presentations will assess the student's ability to identify, discuss and analyze ethical principles and issues in the humanities and the importance for following ethically acceptable behavior and practices. The written exam will assess the students' understanding of the course material and their ability to form and present arguments related to research ethics and academic integrity. Attendance and participation allow students to critically process and interpret what they have learned through readings and lectures.								
Student Study Effort Expected	Class contact:							
	▪ Lecture/seminar/oral presentation						13 Hrs.	
	Other student study effort:							
	▪ Self-study and group work						15 Hrs.	
	▪ Assignment preparation						15 Hrs.	
	Total student study effort						43 Hrs.	
Reading List and References	Jeremy Knox, <i>AI and Education in China: Imagining the Future, Excavating the Past</i> . Taylor & Francis, 2023.							
	Benjamin H. Bratton, Anna Greenspan and Bogna Konior, eds. <i>Machine Decision Is Not Final: China and the History and Future of Artificial Intelligence</i> . Urbanomic: 2024.							
	JAN KRIKKE, "China's ancient worldview shines light on future of AI," Asian Times, 2018, 2,5 https://asiatimes.com/2018/02/chinas-ancient-world-view-shines-light-future-ai/							
	扬·克里克,“前往人工智能的未来, 要先回到中国的历史,” 观察者, 2018,2,21 https://www.quancha.cn/JanKrikke/2018_02_21_447504.shtml							

	<p>Shuangye Chen & Bruce Macfarlane Dawson, A. G. (2023). "Academic Integrity in China" https://link.springer.com/referenceworkentry/10.1007/978-981-287-079-7_32-1</p> <p>Stephen Gow & Qingyang Sun. "Academic Integrity in China: Challenges for Policy, Practice, and Quality Assurance in Higher Education" https://link.springer.com/referenceworkentry/10.1007/978-3-031-39989-3_175</p> <p><i>Artificial Intelligence and Academic Integrity</i>. Aspen.</p> <p>Ethics in Generative AI. https://www.datacamp.com/tutorial/ethics-in-generative-ai</p> <p>Stenmark, C. K. and Winn, N. A. (2015). Ethics in the Humanities pp.1-14. In <i>Handbook of Academic Integrity</i>. Springer.</p> <p>Diebel-Fischer, H. Research Ethics in the Digital Age: Fundamentals, and Problems (2018). In Dobrick, F. M., Fischer, J. and Hagen, L. M. (eds). <i>Research Ethics in the Digital Age Ethics for the Social Sciences and Humanities in Times of Mediatization and Digitization</i>. Springer</p> <p>馮象, "我是阿爾法: 論人機倫理," 《新國際》, https://www.newinternationalism.net/?p=6966</p>
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Subject Description Form

Subject Code	ABCT/AP/FSN5R07
Subject Title	Academic Integrity and Ethics in Science
Credit Value	1
Level	5
Pre-requisite / Co-requisite / Exclusion	None
Objectives	<ol style="list-style-type: none"> 1. Raise students' awareness of the importance of adhering high standards of academic integrity. 2. Enhance students' ability to critically analyse ethical issues and make appropriate ethical decisions. 3. Equip students in science with a deep understanding and respect of academic integrity and ethics that they can apply in their scientific research and use of generative artificial intelligence (AI) at PolyU as well as in their future professional endeavours.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Demonstrate knowledge and understanding of the concepts and principles of academic integrity and ethics. b. Demonstrate awareness and ability to analyse academic integrity and ethical issues, such as copyright and plagiarism, and act properly to avoid academic and ethical misbehaviours. c. Recognise important ethical issues and practices in a university context. d. Understand the implications and concerns on academic integrity raised by the latest technology, such as ChatGPT and other Generative Artificial Intelligence (GenAI) tools. e. Identify and deal with complex ethical and professional issues in discipline-specific settings, and be able to communicate effectively the issues to the stakeholders and the public. f. Develop a consciousness of prevailing ethical issues and dilemmas in relation to their specific scientific research area and generative AI. g. Critically analyse and debate scenarios of potential or actual ethical misconduct within the scope of their scientific discipline and generative AI. h. Discuss the extension and application of research ethics principles to professional and personal codes of conduct in the context of scientific integrity and societal wellbeing.
Subject Synopsis / Indicative Syllabus	<ul style="list-style-type: none"> • The Necessity for Ethics Training: Understanding ethical behaviour in scientific research and generative AI through case studies and learning from past errors. • Philosophy and Ethics Codes: Origins and applications of ethical guidelines. • The Intersection of Culture, Religion, and Law: Understanding the connection between these and ethical codes of conduct. • Research Project Ethical Clearance: Procedures, methodologies, and

	<p>considerations for obtaining ethical approval.</p> <ul style="list-style-type: none">• Discipline-Specific Ethics: Common problems, guiding principles, and discipline-specific scenarios in science, including use of animals and human beings in scientific research, gene editing, societal impact, environmental and security issues, etc.• Ethics and Human Behaviour: Individual, professional, and societal responsibilities in the context of the ethical use of generative AI.• Ethical Information Use: Comprehension of copyright, plagiarism, and appropriate citation, particularly for research and scientific writing that involve the use of generative AI.																																																
Teaching / Learning Methodology	<p>Lectures: Related knowledge and background will be introduced. Case studies will be employed to illustrate the relevant issues. Guest speakers will be invited to deliver guest lectures on selected topics if deemed necessary. Interactive discussions will be fostered to stimulate critical thinking and propose ethical solutions and decision-making strategies.</p> <p>Group presentations: Groups of students will deliver presentations on selected topics and answer questions from the lecturer and other students. This will reinforce their teamwork, enable them to have a better understanding on ethnics in science, and promote collaborative learning and the application of ethical principles.</p>																																																
Assessment Methods in Alignment with Intended Learning Outcomes	<table><tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="8">Intended subject learning outcomes to be assessed</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th><th>g</th><th>h</th></tr><tr><td>1. Individual assignment and on discipline-related scenario/case analysis</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>2. Group presentation</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>Total</td><td>100%</td><td colspan="8"></td></tr></table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <ol style="list-style-type: none">1. Each student will be required to submit an assignment on discipline-related scenario/case analysis, which will assess the student's ability to identify and analyse ethical issues in related fields and figure out how these could be avoided or resolved.2. Students will be grouped to deliver presentations on selected topics, which will assess their ability to present and argue points in support of their rationale. <p>The subject will be assessed on a Pass/Fail grading mechanism.</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed								a	b	c	d	e	f	g	h	1. Individual assignment and on discipline-related scenario/case analysis	50%	✓	✓	✓	✓	✓	✓	✓	✓	2. Group presentation	50%	✓	✓	✓	✓	✓	✓	✓	✓	Total	100%								
Specific assessment methods/tasks	% weighting			Intended subject learning outcomes to be assessed																																													
		a	b	c	d	e	f	g	h																																								
1. Individual assignment and on discipline-related scenario/case analysis	50%	✓	✓	✓	✓	✓	✓	✓	✓																																								
2. Group presentation	50%	✓	✓	✓	✓	✓	✓	✓	✓																																								
Total	100%																																																
Student Study Effort Expected	<table><tr><td>Class contact:</td><td></td></tr><tr><td>▪ Lecture/seminar/workshop/presentation</td><td>13 Hrs.</td></tr><tr><td>Other student study effort:</td><td></td></tr><tr><td>▪ Self study and group work</td><td>13 Hrs.</td></tr><tr><td>▪ Assignment preparation</td><td>13 Hrs.</td></tr><tr><td>Total student study effort</td><td>39 Hrs.</td></tr></table>	Class contact:		▪ Lecture/seminar/workshop/presentation	13 Hrs.	Other student study effort:		▪ Self study and group work	13 Hrs.	▪ Assignment preparation	13 Hrs.	Total student study effort	39 Hrs.																																				
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Other student study effort:																																																	
▪ Self study and group work	13 Hrs.																																																
▪ Assignment preparation	13 Hrs.																																																
Total student study effort	39 Hrs.																																																

Reading List and References	<ul style="list-style-type: none"> • Saxena, A., (2019). <i>Ethics in Science: Pedagogic Issues and Concerns</i>. Springer. • Rollin, B. E., (2006). <i>Science and ethics</i>. Cambridge University Press. • Bretag, T (2016). <i>Handbook of academic integrity</i>. Springer Singapore. • Rettinger, D. A., & Gallant, T. B. (2022). <i>Cheating Academic Integrity: Lessons from 30 Years of Research</i>. Wiley. • Holbrook, J. B., & Mitcham, C., (2015). <i>Ethics, science, technology, and engineering: a global resource (2nd edition)</i>. Gale, Cengage Learning. • Comstock, G., (2010). <i>Life science ethics (2nd edition)</i>. Springer. • Von Braun, J., S. Archer, M., Reichberg, G. M. & Sánchez Sorondo, M., (2021). <i>Robotics, AI, and Humanity: Science, Ethics, and Policy</i>. Springer Nature. • Loukides, M., Mason, H. & Patil, D. J., (2018). <i>Ethics and Data Science</i>. O'Reilly Media, Inc. • Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. <i>Innovations in Education and Teaching International</i>, 1-12. https://doi.org/10.1080/14703297.2023.2190148
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Faculty Subjects

Subject Description Form

Subject Code	CE603
Subject Title	Research Frontiers in Construction and Environment
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>This subject is intended to provide students with:</p> <ol style="list-style-type: none"> 1. a good understanding of the research foci and achievements of the Faculty and its constituent departments 2. a broad perspective of key research issues in the broad field of construction and environment 3. general knowledge of the current status and future challenges of key areas of FCE and their relationship with the student's own research 4. an exposure to different research cultures, techniques and approaches employed in different research areas and how they may be exploited in the student's own work 5. opportunities to interact with leading scholars from the four constituent departments of FCE 6. opportunities to interact with fellow research students to lay the groundwork for future collaborations
Intended Learning Outcomes	<p>Upon completion of the subject, students will possess:</p> <ol style="list-style-type: none"> a. a broad perspective of key research issues in the field of construction and environment; b. a good knowledge of the wide range of expertise available in the Faculty; c. an understanding of the different approaches employed in different research areas; and d. an awareness of opportunities for research collaborations in the Faculty
Subject Synopsis / Indicative Syllabus	<p>Overview of Research in FCE and selected topics in the field of construction and environment which may include:</p> <p>Urban Planning and Management; Construction Management; Construction Technology; Renewable Energy Applications; Transportation Engineering; Structural Engineering; Environmental Science and Engineering; Geotechnical Engineering; Hydraulic and Coastal Engineering; Remote Sensing and Geographic Information Systems; and Modern Positioning Technology.</p>

Teaching / Learning Methodology	A group of academic staff from the four constitute departments of FCE will share the teaching of the subject. The lecturers will all be active researchers in their fields and they will each provide a critical exposition of the current status and future challenges in their own/related research areas. Ample opportunities will be provided for classroom discussions.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. In-class test*	60%	✓	✓	✓	✓		
	2. Project report	40%	✓	✓	✓	✓		
	Total	100%						
<p>*Students should attempt at least 70% out of the total number of the in-class tests held in individual lectures.</p> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>In-class tests can evaluate students’ understanding gained at each lecture efficiently and effectively.</p>								
Student Study Effort Expected	Class contact:							
	▪ Lecture		39 Hrs.					
	Other student study effort:							
	▪ Reading of reference materials		24 Hrs.					
	▪ Writing project report		60 Hrs.					
	Total student study effort		123 Hrs.					
Reading List and References	To be provided by individual teaching staff.							

Subject Description Form

Subject Code	CE620
Subject Title	Research Methods
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Basic knowledge on Probability
Objectives	<ul style="list-style-type: none"> • To provide an understanding of the fundamental principles and techniques for scientific research. • To enable students to properly identify and apply appropriate research methodologies to their research problems. • To enable students become proficient in data analysis, statistical tests and writing for scientific research.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Understand research theory, research basics and scientific thinking. b. Understand a range of research methods for exploratory data analysis and modelling techniques. c. Master techniques for thesis/paper/proposal writing and scientific presentation. d. Appreciate the limitation of the learned theory/methods/techniques. e. Apply the learned theory/methods/techniques to their research projects.
Subject Synopsis / Indicative Syllabus	<p>Research theory Research basics. Research theory. Research method. Research ethics. Research attitude. Research values. Research wisdom. PhD Research.</p> <p>Research cycle: from broad topic to hypothesis Selection of research topic. Understanding and interpretation of the literature. Recognition of new questions. Research hypothesis. Making hypothesis. Design of experiments. Analysis and interpretation of the results. Presentation of the results.</p> <p>Research design Components of experimental design. Guidelines for experiment design. Cause-effect analysis. Ideas to learn from classic scientific experiments. Consideration of unexplained variations. Sample size. Sampling strategy. Significance.</p>

	<p>Research thinking</p> <p>Components and ways of creative thinking. Ways of thinking leading to great innovation. Ways of thinking by great scientists and inventors. General scientific principles to guide thinking. Ways to improve creativity. Creative block.</p> <p>Research writing/presentation</p> <p>Ways of writing. Type of proposals and proposal writing. Construction of title/heading and logic flow. Techniques for writing abstract, introduction, body, discussion and conclusion. Guidelines for organizing citations and references. Ethics issue. Common mistakes in presentation. Guidelines for good presentation.</p> <p>Statistical analysis and modelling</p> <p>Linear regression. Multiple linear regression. Geographical weighted regression. Robust regression. Outliers detection. Association rules mining. Clustering. Time series analysis. Big data analysis.</p> <p>Result interpretation: Statistical significance tests</p> <p>Steps in Testing for Statistical Significance. Selection of a probability of error level (alpha level). Various tests (Chi square test, T-test, U-test, Z-test). Interpretation of test results.</p>								
Teaching / Learning Methodology	Lectures and class discussions are followed by problem based tutorial assignments that are used to practice of theory and methods learnt during lectures in solving student’s discipline oriented problems.								
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						
			a	b	c	d	e		
	1. Assignments	20%		✓	✓		✓		
	2. Tests	40%	✓	✓	✓	✓			
	3. Projects	40%	✓	✓	✓	✓	✓		
	Total	100%							
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Assignments and projects are designed to apply learned concepts to practical problems.</p> <p>Tests are designed to formally assess the intended learning outcomes.</p> <p>Students are expected to achieve a minimum standard to be able to obtain a passing grade in line with criterion referenced assessment approach.</p>									

Student Study Effort Expected	Class contact:	
	▪ Lectures	39 Hrs.
	Other student study effort:	
	▪ Assignments and self-study	81 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	<p>Allhoff F (ed.) 2009 <i>Philosophies of the Sciences: A Guide</i>, John Wiley & Sons.</p> <p>Ang, A. H-S., and Tang, W.H. (2007). <i>Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering</i>, 2nd Edition, Wiley, John Wiley & Sons, Inc.</p> <p>Campbell S 2004 <i>Flaws and Fallacies in Statistical Thinking</i>. Dover Publications.</p> <p>Dielman TE 2009 <i>Applied Regression Analysis, A Second Course in Business and Economic Statistics</i>, South-Western, Fourth Ed.</p> <p>Dowson C 2007 <i>A Practical Guide to Research Methods</i>, Spring Hill House.</p> <p>Gonick and Smith 1993 <i>Cartoon Guide to Statistics</i>, Harper Perennial Pub.</p> <p>Good PI, JW Harvin 2003 <i>Common Errors in Statistics (and how to avoid them)</i> Wiley.</p> <p>MINITAB Manual: Introduction to the Practice of Statistics,. Univ. of Toronto. http://www.msubilings.edu/mathfaculty/mmcbride/MiniTabManual.pdf</p> <p>Kutner, Nachtsheim, and Neter 2004 <i>Applied Linear Regression Models</i>, McGraw Hill. Pólya G. 1945 <i>How to Solve It</i>, Princeton University Press.</p> <p>Rugg G, MPetre 2007 <i>A Gentle Guide to Research Methods</i>, Open University Press, McGraw-Hill Education.</p> <p>Trochim WM2012 <i>Research Methods Knowledge Base</i>, Cornell University, http://trochim.human.cornell.edu/kb/index.htm.</p> <p>Walliman NSR 2011 <i>Research methods: the basics</i>. London: Routledge.</p>	

Subject Description Form

Subject Code	CE631
Subject Title	Simulation and IT Applications in Construction
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>This course provides an overview of quantitative methods used for design and analysis of construction operations to maximize productivity and resource utilization through Discrete Event Simulation (DES), System Dynamics (SD), and Agent Based Simulation (ABS).</p> <p>This subject intended to equip students with an understanding of the roles of Geo-IT and Building Information Modelling (BIM) in practice and research, and introduce a state-of-the-art Geo-IT and BIM-based technologies for construction simulation and management.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> Understand the fundamentals of simulation and IT principles. Understand the techniques of data analysis and modelling in simulation and IT areas. Apply knowledge of simulation and IT to construction projects. Communicate with others in a clear and articulated manner. Identify and propose solutions to construction productivity and presentation problems. Identify and study the appropriateness, advantages, and limitations of each simulation and IT techniques for different construction problems.
Subject Synopsis / Indicative Syllabus	<p>The subject will cover the following content:</p> <p>Queueing Theory: a brief introduction to queueing theory, its relationship with simulation, discussion of queueing theory assumptions and limitations in construction applications, and then comparison with simulation approach.</p> <p>Discrete Event Simulation (DES): introduction to the principles of modelling and simulation using the DES approach, Monte Carlo simulation approach and its application to construction operations, analysis of simulation input data and outputs, introduction to simulation languages in construction, and then focus on simulation for construction operations associated with the related analysis. Specific emphasis will be placed on modelling and simulating heavy and highway construction,</p>

	<p>underground construction technologies, as well as earthmoving, building construction, and tunnelling operations. Also, WebCYCLONE, STROBOSCOPE/EZSTROBE, Keystone, and CRYSTALBALL simulation packages will be introduced.</p> <p>System Dynamics (SD): introduction to the principles of modelling using SD approach, design models for construction operations using SD with a focus on earthmoving operations and civil engineering. Vensim package will be introduced.</p> <p>Agent Based Simulation (ABS): introduction to the principles of modelling using ABS approach, comparison of DES, SD, and ABS as well as their advantages and limitations in construction and civil engineering applications. AnyLogic and ABSEMO software will be introduced.</p> <p>Building Information Modeling (BIM):</p> <ul style="list-style-type: none"> • Introduction to BIM, and its applications in project planning, construction management, and property/facility management. • Introduction to the state-of-the-art BIM-based technologies. • Discussion on future research on BIM. <p>Geo-IT for Construction Simulation and Management:</p> <ul style="list-style-type: none"> • Introduction to Geo-IT, GIS, and their applications in construction simulation and management. • 3D mapping and modelling of outdoor and indoor environments of construction sites using UAV-based photogrammetry and simultaneous localization and mapping (SLAM) technologies. • 3D GIS based analytics for construction simulation and management. • Integration of GIS and BIM for construction simulation and management.
Teaching / Learning Methodology	<p>The course includes a combination of lectures, assigned readings, quizzes, a series of weekly individual assignments, and a class project (term project) for modelling and analysing actual construction operations in addition to one test.</p> <p>The lectures aim to provide the students fundamental concepts and principles of advanced simulation, Geo-IT and BIM technologies to solve construction problems. Assigned readings from literature will guide students to better understand the discussed material through active learning approach. Assignments will improve the problem solving skills for students. Students will be asked to complete a term project on their</p>

	topic of interest.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d	e	f
	1. Quizzes	20%	✓	✓	✓		✓	✓
	2. Project	40%			✓	✓	✓	✓
	3. Test	40%	✓	✓	✓		✓	✓
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture			39 Hrs.				
	▪ Project Seminars			11 Hrs.				
	Other student study effort:							
	▪ Reading of reference materials			46 Hrs.				
	▪ Writing project report			24 Hrs.				
	Total student study effort			120 Hrs.				
Reading List and References	<ul style="list-style-type: none">• Halpin, Daniel W. and Riggs, Leland S. (1992). Planning and Analysis of Construction Operations. John Wiley & Sons, New York, NY.• Banks, J., Carson II, J., Nelson, B., and Nicol, D. (2010). Discrete-Event System Simulation. 5th Edition, Pearson Prentice Hall, Pearson Education, Inc., Upper Saddle River, NJ.• Jabri, A. and Zayed, T. (2017). “Agent-based modelling and simulation of earthmoving operations,” J. of Automation in Construction, September, 81: 210-223.• Mirahadi, F. and Zayed, T. (2016). “Simulation-Based Construction Productivity Forecast Using Neural-Network-Driven Fuzzy Reasoning,” J. of Automation in Construction, May, Vol. 65, pp. 102-115.• Alzraiee, H., Zayed, T., and Moselhi, O. (2015). “Dynamic Planning of Construction Activities using Hybrid Simulation,” J. of Automation in Construction, Volume 49, Part B, Jan, PP. 176-192• Elwakil, E. and Zayed, T. (2014). “Construction Knowledge Discovery System Using Fuzzy Approach,” Canadian J. of Civil Engineering (CJCE), October, 42(1): 22-32.• Liu, Y. and Zayed, T. (2014). “Cash Flow Modeling Construction Projects,” J. of Engineering, Construction and Architectural Management, February, 21(2): 170-189.• El-Abbasy, M., Zayed, T., Ahmed, M., Alzraiee, H., and Abouhamad, M. (2013). “Contractor Selection Model For Highway Projects Using Integrated Simulation and Analytic Network Process,” J. of Construction Engineering and Management, ASCE, July, 139(7): 755-767.• Zayed, T. (2009). “Stochastic Productivity Assessment of Continuous Flight Auger Piles,” J. of Architectural Science Review (ASR), Australia, March, 52(1): 13-23.• Zhang, C., Zayed, T., and Hammad, A. (2008). “Resource Mamt of							

	<p>Bridge Deck Rehabilitation: Jacques Cartier Bridge Case Study,” J. of Construction Eng. & Mgmt, ASCE, May, 134(5): 311-319.</p> <ul style="list-style-type: none"> • Zayed, T. and Halpin, D. (2004). “Simulation as a Tool for piles Productivity Assessment,” J. of Construction Eng and Mgmt, ASCE, May/June, 130(3): 394-404. • Zayed, T. and Halpin, D. (2001). “Simulation of Concrete Batch Plant Production,” J. of Construction Eng. and Management, ASCE, April, 127(2): 132-141. • B. Wu, 2017. Photogrammetry – 3D from Imagery, In D. Richardson, N. Castree, M.F. Goodchild, A. Kobayashi, W. Liu, and R.A. Marston (Ed.): The International Encyclopedia of Geography, John Wiley & Sons, Ltd., New York, pp. 1-13, doi: 10.1002/9781118786352.wbieg0942. • B. Wu and S. Zhang, 2016. Integration of GIS and BIM for Indoor Geovisual Analytics. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XLI-B2, pp.455-458, doi:10.5194/isprs-archives-XLI-B2-455-2016. • Eastman, C., Eastman, C.M., Teicholz, P., Sacks, R. and Liston, K. (2011). BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, John Wiley & Sons. • Bryde, D., Broquetas, M. and Volm, J.M. (2013). The Project Benefits of Building Information Modelling (BIM), International Journal of Project Management, Volume 31, Number 7, pp. 971-980. • Yalcinkaya, M., & Singh, V. (2015). Patterns and trends in building information modelling (BIM) research: A latent semantic analysis. Automation in construction, 59, 68-80. • Becerik-Gerber, B., Kensek, K. (2009). Building information modelling in architecture, engineering, and construction: Emerging research directions and trends. Journal of professional issues in engineering education and practice, 136(3), 139-147. • Volk, R., Stengel, J., & Schultmann, F. (2014). Building Information Modeling (BIM) for existing buildings – Literature review and future needs. Automation in construction, 38, 109-127. • Wong, J.K.W., & Zhou, J. (2015). Enhancing environmental sustainability over building life cycles through green BIM: A review. Automation in Construction, 57, 156-165. • Succar, B. (2009). Building information modeling framework: A research and delivery foundation for industry stakeholders. Automation in construction, 18(3), 357-375.
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Subject Description Form

Subject Code	CE632
Subject Title	Advanced Energy Technologies and Analytics
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject aims to introduce the advanced energy technologies and the associated analytical methodologies for three important applications: energy optimization and diagnostic technologies to reduce energy demand, technologies for effective use of various renewable energy resources, and thermal/electrical energy storage technologies
Intended Learning Outcomes	<ul style="list-style-type: none"> a. Able to appreciate and select proper advanced energy technologies for energy saving, effective use of renewable energy and power supply-demand balance in the context of buildings and districts; b. Able to analyze quantitatively the above energy technologies for the purposes of technologies integration, optimization and operation/control; c. Able to identify the limitations of the technologies in applications and gaps which need for future development.
Subject Synopsis / Indicative Syllabus	<p>Design and control optimization technologies: Uncertainty analysis and uncertainty-based control and design, modelling and optimization for real-time applications, smart grid, demand response methods and grid-responsive buildings.</p> <p>Diagnostic technologies: Data analytics for building performance diagnostics: (measurement quality, data fusion and data-driven methods); Big Data analytics and their applications in buildings (data mining techniques, supervised learning and unsupervised learning).</p> <p>Solar energy technologies: Passive solar energy, building-integrated solar photovoltaics, solar cells (thin film solar cells, perovskite solar cells, dye-sensitized solar cells, organic solar cells), solar thermal energy (solar collectors, solar air-conditioning).</p> <p>Wind and geothermal energy technologies: wind power fundamentals, wind turbine technologies (horizontal axis, vertical axis, building-integrated), offshore wind farm, hybrid solar-wind generations, ground source heat pumps.</p> <p>Energy storage technologies: Thermal energy storage and phase change materials (PCM); Various fuel cells, such as proton exchange membrane fuel cells (PEMFCs), solid oxide fuel cells (SOFCs), and</p>

	microbial fuel cells; Various batteries, such as Li-ion battery, Li-air battery, and Zn-air battery.							
Teaching / Learning Methodology	Teaching periods will adopt a range of methods which include lectures, guided reading tutorials, and small projects. The lectures aim to provide the students fundamental concepts and principles as well as quantitative analytic methods of advanced energy technologies. Guided reading will guide students in reading the literature on the selected topics. Tutorial will be used to develop students' problem solving skills. Students will be asked to complete a small project on a selected topic.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c			
	1. Coursework	25%	✓	✓	✓			
	2. Mini-tests	25%	✓	✓				
	3. Oral Examination	50%	✓	✓	✓			
	Total	100%						
Assessments of the subject will be based on coursework (25%), in-class tests (25%), and final examination (50%)								
*Oral Examination: Each student will be assessed by two lecturers on two subjects out of the above five topics respectively, each for about twenty minutes on each subject (about 40 minutes for each student). Each student can select one subject and the second is randomly assigned by the subject examiner. The oral examination of each subject consists of two sessions. The first session is the Q/A session on the questions/items given by the lecturer. The second session is the student led discussion. The student will give his/her views and discuss with the lecturer on one topic selected by himself/herself within the subject area. The objective of both sessions is to evaluate the students' understanding and ability in using the knowledge learnt from the viewpoints of depth and breadth. On each subject, a set of basic items/questions will be developed and the lecturer will choose some of these items in the first session of the oral examination.								
Student Study Effort Expected	Class contact:							
	▪ Lecture		20 Hrs.					
	▪ Tutorial		7.5 Hrs.					
	▪ Student seminars		6 Hrs.					
	▪ Test		2.5 Hrs.					
	▪ Examination		3 Hrs.					
	Other student study effort:							
▪ Reading of reference materials		60 Hrs.						

	<ul style="list-style-type: none"> ▪ Writing project report 	20 Hrs.
	Total student study effort	119 Hrs.
Reading List and References	<ol style="list-style-type: none"> 1. Wang S.W., Intelligent Buildings and Building Automation, Spon Press (Taylor & Francis), London and New York, Nov.2009 2. Shan K, Wang SW, Yan CC and Xiao F. "Building demand response and control methods for smart grids: A review", Science and Technology for the Built Environment, V22(6), pp.692-704, 2016. 3. Wang S.W. and Ma Z.J., "Supervisory and Optimal Control of Building HVAC Systems: A Review", HVAC&R Research, V14(1), pp.3-32, 2008 4. McGowan, John J., Energy and Analytics: Big Data & Building Technology Integration, Published by The Fairmont Press, Inc., 2015. 5. Manwell, J.F., J.G. McGowan and A.L. Rogers, Wind Energy Explained Theory, Design and Application, John Wiley & Sons, Ltd., England, 2010 6. Wortman, A.J., Introduction to Wind Turbine Engineering, Butterworth Publishers, Boston, 1983. 7. Simon J. Rees, Advances in ground-source heat pump systems, Duxford, UK: Woodhead Publishing is an imprint of Elsevier 2016 8. Duffie, J.A. and William A. Beckman, Solar Engineering of Thermal Process, John Wiley & Sons, Inc., 1991. 9. Athienitis, A K and M Santamouris, Thermal Analysis and Design of Passive Solar Buildings, James and James (Science Publishers) Ltd, London, 2002. 10. Partain, L.D., Solar Cells and Their Applications, John Wiley & Sons, Inc., New York, 1995. 11. Sick, F. and Thomas Erge, Photovoltaics in Buildings, James and James (Science Publishers) Ltd., London, 1996. 12. John Wiley and Sons: Handbook of Clean Energy Systems, 2014. 13. Meng Ni, Tim S. Zhao (editors), Solid oxide fuel cells – from materials to system modeling, The Royal Society of Chemistry 2013 14. Peng Tan, Bin Chen, Haoran Xu, Houcheng Zhang, Weizi Cai, Meng Ni, Meilin Liu, Zongping Shao, Flexible Zn- and Li-air batteries: recent advances, challenges, and future perspectives, Energy and Environmental Science, 2017, Issue 10, 2056-2080. 15. Peng Tan, Wei Kong, Zongping Shao, Meilin Liu, Meng Ni, Advances in modeling and simulation of Li-air batteries, Progress in Energy and Combustion Science, 2017, Volume 62, pp.155-189. 16. Bent Sorensen, Hydrogen and Fuel cells (Second Edition), 2012. 	

Subject Description Form

Subject Code	CE633
Subject Title	Environment and Climate Change
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Students should have basic knowledge of chemistry, physics, and mathematics.
Objectives	This subject aims to provide students with an overview of the factors affecting the indoor and outdoor environmental quality, and to introduce chemical and physical processes affecting air pollution and climate, and equip Ph.D. students with advanced experimental and modeling skills for conducting atmospheric research.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able:</p> <ol style="list-style-type: none"> to understand how building system and green building design affect the indoor and outdoor environments, and how to make evaluation through site measurement, and computer simulation. to understand advanced chemistry, including gas-phase, aqueous phase and heterogeneous processes, and some physical/dynamical processes related to air pollution and climate change to grasp advanced experimental and modeling techniques to apply learned knowledge and skills in their atmospheric research
Subject Synopsis / Indicative Syllabus	<p>This subject covers the following contents:</p> <ol style="list-style-type: none"> <u>Indoor and urban environment</u> Effect of indoor environmental quality on health, comfort and well-being, aspects of indoor environmental quality and parameters used to describe performance (air, thermal, lighting and acoustics); indoor air quality assessment, key monitoring parameters, relationship between indoor air quality and comfort, health and productivity, indoor air quality guideline, improvement strategies, ventilation and inter-unit dispersion in residential buildings; pedestrian wind and thermal comfort in the urban environment, basic parameters, methods for the improvement. <u>Atmospheric pollution</u> Atmospheric structure, radiation, stability, circulation, basic chemical kinetics; kinetic theory of gases, Chapman mechanism, catalytic cycles, polar ozone depletion; photochemical smog, hydrocarbon oxidation mechanisms, nitrogen oxides, halogens; particulate matter and haze, aerosol composition and sources, mass transfer, formation

	<p>of sulfate, nitrate and organic aerosols; laboratory experiments and field observations, measurement techniques for criteria pollutants, back trajectories, source apportionment, chemical box model, chemistry transport model.</p> <p>3. <u>Climate change</u></p> <p>Historical overview of climate change science, changes in atmospheric constituents and radiative forcing, factors affecting climate, greenhouse gas effect, past climate records; climate models and their evaluation, understanding and attributing climate change, global and regional projections of future changes in climate; assessment of adaptation practices, options, constraints and capacity, synergies and trade-offs between adaptation and mitigation, assessing key vulnerabilities and the risk from climate change, perspectives on climate change and sustainability, mitigation in varied systems.</p>							
Teaching / Learning Methodology	<p>The students will be divided into groups to finish a group project which will include site measurement and computer simulation. The subject will include lecture, workshop, computer lab session, and seminar.</p> <p>Lectures: will introduce fundamental knowledge and theoretical basis for indoor air quality, atmospheric chemistry and climate change.</p> <p>Workshops/seminars: for students to present and discuss key problems and potential issues for selected case studies.</p> <p>Group project: require students to prepare an individual report based on a specific environment and climate change issues. Students are also required to give an oral presentation.</p>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. Assignments	60%	✓	✓	✓	✓		
	2. Awritten report and oral presentation	40%	✓	✓	✓	✓		
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture							39 Hrs.
	Other student study effort:							
	▪ Reading of reference materials							39 Hrs.
	▪ Group project report							39 Hrs.
	Total student study effort							117 Hrs.
Reading List and	1. Colin Baird (2012) Environmental Chemistry, Fifth Edition, W.H.							

References	<p>Freeman and Company</p> <ol style="list-style-type: none"> 2. Seinfeld J H, Pandis S N. Atmospheric chemistry and physics: from air pollution to climate change[M]. John Wiley & Sons, 2016. 3. Jacob D. Introduction to atmospheric chemistry[M]. Princeton University Press, 1999. 4. Brasseur G. and Jacob D., Modeling of Atmospheric Chemistry, Cambridge University Press, 2017. 5. Goosse, H., Climate System Dynamics and Modelling, Cambridge University Press, 2015. 6. IPCC Fourth and Fifth Assessment Report: WG1 – The Physical Science Basis https://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml 7. Introduction to Climate Change, A.E. Dessler, Cambridge University Press, 2012. QC903.D46EPD 8. 2nd Climate Change consultant report http://www.epd.gov.hk/epd/english/climate_change/files/Climate_Change_Report_final.pdf 9. P.M. Bluyssen (2009) <i>The Indoor Environmental Handbook</i>. Earthscan. 10. BEAM Society. <i>Building Environmental Assessment Method Plus – Existing Buildings</i>. 11. BEAM Society. <i>Building Environmental Assessment Method Plus – New Buildings</i>.
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Subject Description Form

Subject Code	CE634
Subject Title	Urban Big Data
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>This course aims to provide in-depth knowledge and hands-on techniques on the urban big data mining. This course will introduce the concept of urban big data, and the methods for acquiring, processing, and analysing these data sets. It will also introduce applications in environment, transportation, housing, urban, business, and socio-economics. The research issues in urban big data includes challenges from the automated data management, cloud computing, tackling massive flow, security and privacy problems. This course will cover these issues.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> Understand the definition and principles of urban big data Obtain broad knowledge in fundamental concepts, algorithms and techniques for big data mining and their applications to large-scale data warehouses and big data analytics Understand research issues and topics in big data mining and analytics
Subject Synopsis / Indicative Syllabus	<ul style="list-style-type: none"> • Introduction of urban big data • Big data processing <ul style="list-style-type: none"> ○ Aggregation ○ Systematic, stochastic, and gross error cleaning ○ Graphic and image cleaning ○ Information delivery • Method and techniques in big data analysis and mining <ul style="list-style-type: none"> ○ Visualization and spatial-temporal analytics ○ Crisp set theory ○ Extended set theory ○ Bionic method ○ GIS data mining ○ Remote sensing image mining • Urban big data applications

	<ul style="list-style-type: none"> ○ Transportation ○ Traffic monitoring ○ Urban planning ○ Smart cities ○ Logistics ○ Urban Infrastructure ○ Business ○ Internet of Things 							
Teaching / Learning Methodology	<ol style="list-style-type: none"> 1. Lectures to explain theories and methodology; 2. Assignments to reinforce the theories and methodology introduced during the lectures, so as to enable students to gain deeper understanding of the principles and techniques, to become critical in thinking; and 3. A group project is designed to enhance the critical thinking, team spirit, problem solving skill, leadership and presentation skill. 							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c			
	1. Assignments	60%	✓	✓	✓			
	2. Class project	40%	✓	✓	✓			
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture							39 Hrs.
	Other student study effort:							
	▪ Reading of reference materials							52 Hrs.
	▪ Writing project report							39 Hrs.
	Total student study effort							130 Hrs.
Reading List and References	<ul style="list-style-type: none"> • Textbook: <ul style="list-style-type: none"> ○ Spatial data mining: theory and application / Li, Wang, & Li (2015) • Other reading materials: <ul style="list-style-type: none"> ○ Applied spatial data analysis with R / Bivand, Pebesma, & Gómez-Rubio (2013) ○ Applied spatial analysis of public health data / Lance & Carol (2003) ○ Big data: techniques and technologies in Geoinformatics / Hassan A. Karimi (2014) 							

Departmental Subjects

Building Environment and Energy Engineering

Subject Description Form

Subject Code	BSE6001
Subject Title	Computational Fluid Dynamics
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Mutual exclusions: BSE531 Computational Fire Modelling for Building Design
Objectives	As the computer capacity becomes more and more powerful, and the commercial CFD packages are more widely available, there are increased applications of CFD in postgraduate studies, which eventually will lead to more industrial applications. However, due to the special expertise required, few PhD candidates have the proper fundamental studies with regard to turbulence theory and turbulence modelling, and the special numerical schemes employed to solve the Navier-stokes Partial Differential Equations, which greatly hinders their start-up and further in-depth application of the technique. Therefore, this subject is conceived to fill-up this knowledge gap.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. critically examine turbulence models and understand the limitations of each model; b. select proper models in fluid flow simulation: laminar, RANS or LES; c. treat buoyancy forces; d. use commercial code to simulate flow problems: <ol style="list-style-type: none"> (i) grid generation, boundary condition setting (ii) selection of numerical schemes and solution procedures (iii) convergence control and checking, and (iv) visual and numerical presentation of simulation results; and e. solve steady state and transient flow and heat transfer problems
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> 1. Conservation equations in fluid flow. 3-d Navier-Stokes Equations, buoyancy force approximation. 2. Concepts of turbulence – Reynolds' experiment, and turbulence

	<p>measurements and characterization.</p> <p>3. Reynolds average of flow parameters.</p> <p>4. Time Average Momentum Equations for turbulence flow.</p> <p>5. Closure of the Time-Average Equations – turbulence modeling</p> <p>5.1 Concept of eddy viscosity – Boussinesq Hypotheses</p> <p>5.2 Concept of mixing length</p> <p>5.3 One Equation models, two equation models, esp. k- model</p> <p>5.4 Reynolds stress equation models</p> <p>5.5 Large eddy simulation (LES) and Direction solution of N-Sequations</p> <p>6. Boundary conditions, the log-wall function method.</p> <p>7. Numerical Methods for CFD</p> <p>7.1 Finite volume methods: convection-term discretization method; first-order upwind, and higher-order differencing schemes</p> <p>7.2 Solution algorithms</p> <p>7.3 Finite volume method for unsteady flows</p> <p>8. The use of commercial package.</p> <p>9. Post-processing, flow visualization and obtaining integral properties.</p>							
Teaching / Learning Methodology	<p>The teaching will involve lecture, tutorials and problem solving, and mini-project execution.</p> <p>In particular heads-on experiences with the use of commercial CFD code FLUENT for simple problems. The simplified problems will be tailor made for each student, and expected to link with their research topics. This learning will involve a mini-project. For instance, a student is requested to calculate the pressure head loss for the pipe flow, or convection heat transfer for the natural convection in an enclosed chamber, via comparing their simulation results with known analytical or benchmark experimental results available in the literature.</p>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d	e	
	1. Continuous assignments							
	- Case study (mini-project)	30%	✓	✓	✓	✓		
	- Seminar presentation	20%	✓	✓	✓	✓		
	2. Final examination	50%	✓	✓	✓	✓	✓	
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture				2 x 7 = 14 Hrs.			
	▪ Tutorial				1 x 7 = 7 Hrs.			
	▪ Seminar				3 x 2 = 6 Hrs.			

	▪ Computer simulation: tutorials	3 x 4 = 12 Hrs.
	Other student study effort:	
	▪ Computer simulation and results analysis	3 x 6 = 18 Hrs.
	▪ Self-study	6 x 11 = 66 Hrs.
	Total student study effort	123 Hrs.
Reading List and References	<p>Recommended text books:</p> <ol style="list-style-type: none"> 1. Chung, T.J., <i>Computational Fluid Dynamics</i>, Cambridge University Press, 2010, 2nd edition. 2. Versteeg, H.K. and Malalasekera, M., <i>An Introduction to Computational Fluid Dynamics – The Finite Volume Method</i>, Longman S&T, 1995. 3. Patankar, Suhas V., <i>Numerical Heat Transfer and Fluid Flow</i>, McGraw-Hill, Hemisphere, c1980. <p>Journals:</p> <ol style="list-style-type: none"> 1. International Journal of Heat and Mass Transfer 2. Numerical Heat Transfer 3. International Journal of Heat and Fluid Flow 4. AIAA Journals 5. International Journal of Wind Engineering 	

Subject Description Form

Subject Code	BSE6004
Subject Title	Fire Science and Fire Safety Engineering
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>This course will allow students to understand the fundamentals of fire science and concepts of compartment fire dynamics. It will also help them to develop an understanding of fire growth and the fully developed fire and methods by which potential fire severity can be assessed. Students will learn the application of fire science and fire dynamics for the safety of occupants in buildings, including fire protection system, the detection, suppression and the spread of fire and smoke, and regulatory provisions for fire safety. This course will introduce sufficient knowledge to students and enable them to become future fire researchers and fire safety engineers.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> Demonstrate a working knowledge of basic physical and chemical processes in various fire phenomena Understand the mechanism of ignition, flame spread, and extinction Apply basic sciences to the fire safety design of building Identify the fire risk and hazard, and formulate and solve engineering problems representative of those commonly encountered in the fire protection engineering practice Recognize the need to engage in life-long learning and ability to maintain state of the art fire protection engineering knowledge and skills.
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> Heat transfer in Fire Combustion and Flame Burning dynamics Ignition and flammability Flame Spread Fire Plumes Smoke and Emission Compartment Fires Structure Performance under Fire

	10. Wildland Fires 11. Fire Modelling Principles 12. Fire Engineering Design Principles 13.							
Teaching / Learning Methodology	The teaching will involve lecture, Fire lab demonstrations and computing tools, tutorials and problem solving, and course projects. The course project includes writing a research proposal, conduct theoretical analysis for fire phenomena, and use computational fire modelling code. By doing this course project, students will be able to conduct fire safety assessment in the design of building, and reproduce the fire process in the case of fire investigation.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d	e	
	1. Course project	40%	✓	✓	✓	✓	✓	
	2. Lab session	10%	✓	✓	✓	✓		
	3. Midterm	20%	✓	✓	✓	✓		
	4. Final exam	30%	✓	✓	✓	✓		
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture						2 x 11 = 22 Hrs.	
	▪ Seminar/Presentation						1 x 7 = 7 Hrs.	
	▪ Tutorial						1 x 10 = 10 Hrs.	
	Other student study effort:							
	▪ Project						3 x 8 = 24 Hrs.	
	▪ Self-study						5 x 11 = 55 Hrs.	
	Total student study effort						118 Hrs.	
Reading List and References	Textbooks: 1. James G. Quintiere, Fundamentals of fire phenomena, John Wiley, 2006. 2. Dougal Drysdale, An Introduction to Fire Dynamics, 3 rd edition, John Wiley & Sons, 2011							
	Reference books: 1. E.A. Johnson and K. Miyanishi, Forest Fires, Academic Press, San Diego, 2001. 2. Kevin McGrattan et al. Fire Dynamics Simulator, User's Guide, NIST Special Publication 1019, 6 th edition, NIST, 2017							

Subject Description Form

Subject Code	BSE6005
Subject Title	Indoor and Outdoor Environmental Quality Evaluation and Simulation
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Students should have basic knowledge of physics and mathematics.
Objectives	<p>This subject aims to provide students with an in-depth understanding of the impact of indoor and outdoor environmental quality on building performance, in terms of air quality, lighting, acoustics, thermal and wind comfort and equip research students with advanced experimental and/or modeling skills for conducting indoor and outdoor environmental research.</p> <p>Students are expected to understand the role of human factors in indoor and outdoor environments and how building design can affect the indoor and outdoor environments, and how to make evaluation through site measurement, and computer simulation. The subject will also cover the latest building environmental assessment schemes, such as BEAM Plus and LEED. The students will be divided into groups to finish a group project which will include site measurement and computer simulation. The subject will include lecture, workshop, computer lab session, and seminar.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> understand the role of human factors in indoor and outdoor environmental performance understand the building design needs of various indoor and outdoor environments. conduct environmental evaluation through site measurement, and computer simulation. apply learned knowledge and skills in indoor and outdoor environmental research.
Subject Synopsis / Indicative Syllabus	<p>This subject covers the following contents:</p> <ol style="list-style-type: none"> Indoor environmental quality in relation to building design Introduction to thermal comfort, lighting, acoustics and indoor air quality including their definition, basic parameters, evaluation and simulation. Effects of environmental quality on

	<p>human. Relationship between indoor environmental quality and building design needs. Environmental research methods.</p> <p>2. Outdoor environmental quality in relation to building design</p> <p>Introduction to outdoor environment in terms of acoustics (e.g. CRTN method), wind and thermal comfort (e.g. wind comfort criteria), air quality including definition, basic parameters, evaluation, prediction and simulation. Effects of environmental quality on human. Relationship between outdoor environment and building design needs. Environmental research methods. Examples.</p> <p>3. Rating of indoor and outdoor environmental performance</p> <p>BEAM Plus and LEED. Indoor environmental quality management strategies. Evaluation methods of indoor and outdoor environment.</p>
Teaching / Learning Methodology	<p>The subject will start with a discussion on indoor and outdoor environmental quality, their effects on human beings, and associated building design needs. The students will be asked to conduct an individual project which will include site measurement and/or computer simulation. The subject will include lectures, workshops, computer lab session, and seminars.</p> <p>Lectures:</p> <p>Will introduce fundamental knowledge, theoretical basis, and methodology for indoor and outdoor environmental quality and the associated building design needs.</p> <p>Workshops/seminars:</p> <p>Students are required to apply learned knowledge and skills such as site measurement, and computer simulation in a group project. Students are required to present and discuss key problems and potential issues for selected case studies.</p> <p>Individual project:</p>

	Students are required to prepare an individual report based on a specific indoor or outdoor environmental issue. Students are also required to give an oral presentation.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. Coursework	60%	✓	✓	✓	✓		
	2. Examination	40%	✓	✓	✓	✓		
	Total	100%						
	The coursework will include: <ul style="list-style-type: none">▪ Student Seminar▪ Self-study Report							
Student Study Effort Expected	Class contact:							
	▪ Lecture						39 Hrs.	
	Other student study effort:							
	▪ Reading of reference materials						39 Hrs.	
	▪ Group project report						39 Hrs.	
	Total student study effort						117 Hrs.	
Reading List and References	<div>1. P.M. Bluysen (2009) <i>The Indoor Environmental Handbook</i>. Earthscan.</div> <div>2. BEAM Society. <i>Building Environmental Assessment Method Plus – Existing Buildings</i>.</div> <div>3. BEAM Society. <i>Building Environmental Assessment Method Plus – New Buildings</i>.</div> <div>4. M. Mehta, J Johnson and J Rocafort (1999). Architectural Acoustics, Principles and Design.</div> <div>5. DiLaura DL, Houser KW, Mistrick RG, Steffy GR. 2011. The Lighting Handbook, 10th Edition. The Illuminating Engineering Society, New York, USA.</div>							

Subject Description Form

Subject Code	BSE6101
Subject Title	Research Seminar I
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> understand the importance and strategic value of research and development. develop effective communication skills for both academic and non-academic communities. widen the scope of knowledge and experience.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars every year is also required to be submitted to the Chief Supervisor for assessment.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars once every two years is also required to be submitted to the Chief Supervisor for assessment.</p> <p>The research seminars may or may not be organised by the Department of Building Environment and Energy Engineering and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by a student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students should be awarded one credit per year (for full-time students) or per two years (for part-time students) for completing the research seminar credit requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, students are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the above-mentioned requirement.</p>

Subject Description Form

Subject Code	BSE6102
Subject Title	Research Seminar II
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> understand the importance and strategic value of research and development. develop effective communication skills for both academic and non-academic communities. widen the scope of knowledge and experience.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars every year is also required to be submitted to the Chief Supervisor for assessment.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars once every two years is also required to be submitted to the Chief Supervisor for assessment.</p> <p>The research seminars may or may not be organised by the Department of Building Environment and Energy Engineering and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by a student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students should be awarded one credit per year (for full-time students) or per two years (for part-time students) for completing the research seminar credit requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, students are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the above-mentioned requirement.</p>

Subject Description Form

Subject Code	BSE6103
Subject Title	Research Seminar III
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> understand the importance and strategic value of research and development. develop effective communication skills for both academic and non-academic communities. widen the scope of knowledge and experience.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars every year is also required to be submitted to the Chief Supervisor for assessment.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars once every two years is also required to be submitted to the Chief Supervisor for assessment.</p> <p>The research seminars may or may not be organised by the Department of Building Environment and Energy Engineering and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by a student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students should be awarded one credit per year (for full-time students) or per two years (for part-time students) for completing the research seminar credit requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, students are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the above-mentioned requirement.</p>

Subject Description Form

Subject Code	BSE6104
Subject Title	Research Seminar IV
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> understand the importance and strategic value of research and development. develop effective communication skills for both academic and non-academic communities. widen the scope of knowledge and experience.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars every year is also required to be submitted to the Chief Supervisor for assessment.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a record of seminars attended to the Chief Supervisor for endorsement. A report of no less than 1,500 words (excluding references) on one of the attended seminars once every two years is also required to be submitted to the Chief Supervisor for assessment.</p> <p>The research seminars may or may not be organised by the Department of Building Environment and Energy Engineering and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by a student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students should be awarded one credit per year (for full-time students) or per two years (for part-time students) for completing the research seminar credit requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, students are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the above-mentioned requirement.</p>

Subject Description Form

Subject Code	BSE6105
Subject Title	Practicum I
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure of students in teaching/research -supporting activities/profession services aligning with their research interests.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> develop effective teaching, communication and organisation skills. develop research networks and relationships with peers, supervisors, scholars and administrators within and outside the University. obtain hands-on experiences on teaching/research-supporting activities/professional services and acquire knowledge and skills that will be valuable in their professional development.
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students who are not provided with the TPS Assistantship, irrespective of funding source and mode of study, must complete two training credits before graduation.</p> <p>To complete this subject, full-time students are required to engage in teaching or research supporting activities assigned by the Head of Department or his/her delegate for 6 hours/week in any 13-week semester. Part-time students are required to undertake structured research-supporting activities or professional services aligning with their research interests as a form of training. Upon completion of the training, students are required to submit a report of no less than 1,500 words to the Chief Supervisor. The report should consist of the gains from the training undertaken, the nature of the training, the training period, and the number of hours involved.</p> <p>Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.</p> <p>PhD Students who are required to undertake teaching supporting activities are required to complete the training programmes organised by the Educational Development Centre, English Language Centre/Chinese Language Centre (as required) before the commencement of any teaching supporting activities.</p>

Teaching/Learning Methodology	Nil
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to:</p> <ul style="list-style-type: none"> a. ensure that the teaching/research-supporting activities/ professional services align with the student's research interests, which are structured to be assessed properly; and b. submit, at the end of the training session, an assessment report on the performance of the student, with details of activities undertaken and an overall assessment grade of Pass or Fail.
Student Study Effort Expected	Nil
Reading List and References	Nil

Subject Description Form

Subject Code	BSE6106
Subject Title	Practicum II
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure of students in teaching/research -supporting activities/profession services aligning with their research interests.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> develop effective teaching, communication and organisation skills. develop research networks and relationships with peers, supervisors, scholars and administrators within and outside the University. obtain hands-on experiences on teaching/research-supporting activities/professional services and acquire knowledge and skills that will be valuable in their professional development.
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students who are not provided with the TPS Assistantship, irrespective of funding source and mode of study, must complete two training credits before graduation.</p> <p>To complete this subject, full-time students are required to engage in teaching or research supporting activities assigned by the Head of Department or his/her delegate for 6 hours/week in any 13-week semester. Part-time students are required to undertake structured research-supporting activities or professional services aligning with their research interests as a form of training. Upon completion of the training, students are required to submit a report of no less than 1,500 words to the Chief Supervisor. The report should consist of the gains from the training undertaken, the nature of the training, the training period, and the number of hours involved.</p> <p>Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.</p> <p>PhD Students who are required to undertake teaching supporting activities are required to complete the training programmes organised by the Educational Development Centre, English Language Centre/Chinese Language Centre (as required) before the commencement of any teaching supporting activities.</p>

Teaching/Learning Methodology	Nil
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to:</p> <ul style="list-style-type: none"> a. ensure that the teaching/research-supporting activities/ professional services align with the student's research interests, which are structured to be assessed properly; and b. submit, at the end of the training session, an assessment report on the performance of the student, with details of activities undertaken and an overall assessment grade of Pass or Fail.
Student Study Effort Expected	Nil
Reading List and References	Nil

Departmental Subjects
Building and Real Estate

Subject Description Form

Subject Code	BRE612
Subject Title	Productivity in Construction
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<p>This course provides an overview of quantitative methods used to assess and analysis labor and equipment productivity in construction operations. The students will study various types of equipment including earth moving equipment (excavators, loaders, dozers, scrapers, trucks, etc.); cranes; mixing, transporting, and placing concrete; piling; paving; tunnelling; etc. Innovative and smart methods used to monitor and select the appropriate equipment, its optimal number, capacity and location.</p> <p>Labor productivity will cover the examination of its definitions, what it measures, why it is important, how it affects the total economy, and the main factors affecting its growth. The students will study how to calculate labor productivity, understand the importance of measuring labor productivity, and policies to improve labor productivity, in terms of investment in physical capital, quality of education and training, and technological progress.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Understand the fundamentals of labor and equipment productivity assessment. (b) Identify and study the different factors that impact labor and equipment productivity in construction. (c) Understand the techniques of data analysis and modelling in labor and equipment productivity. (d) Apply knowledge of labor and equipment productivity to construction projects. (e) Communicate with others in a clear and articulated manner. (f) Identify and propose solutions to construction productivity and presentation problems. (g) Identify and study the appropriateness, advantages, and limitations of various types of labors and equipment for different construction problems.
Subject Synopsis / Indicative Syllabus	<p>The subject will cover the following content:</p> <p>Equipment Productivity: a brief initial introduction to equipment productivity, factors that affect various types of construction equipment, discussion of productivity modeling, assumptions, and limitations in construction applications. The students will also study various types of equipment including earth moving equipment (excavators, loaders, dozers,</p>

	<p>scrapers, trucks, etc.); cranes; mixing, transporting, and placing concrete; piling; paving; tunnelling; etc. This part will also discuss the innovative and smart methods used to monitor and select the appropriate equipment, its optimal number, capacity and location.</p> <p>Labor Productivity: introduction to the principles of modeling labor productivity and its application to construction activities, examination of productivity definitions, what it measures, why it is important, how it affects the total economy, and the main factors affecting its growth. The students will study how to calculate labor productivity, understand the importance of measuring labor productivity, and policies to improve productivity, in terms of investment in physical capital, quality of education and training, and technological progress. Specific emphasis will be placed on modeling labor productivity in heavy and highway construction, underground and tunnelling construction, and building construction.</p>								
Teaching / Learning Methodology	<p>The course includes a combination of lectures, assigned readings, quizzes, a series of weekly individual assignments, and a class project (term project) for modeling and analyzing actual labor and equipment productivity in construction operations in addition to two exams.</p> <p>The lectures aim to provide the students fundamental concepts and principles of advanced productivity assessment to solve construction problems. Assigned readings from literature will guide students to better understand the discussed materials through active learning approach. Assignments will improve the problem solving skills for students. Students will be asked to complete a term project on their topic of interest.</p>								
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						
			a	b	c	d	e	f	g
	1. Quiz	10%	✓	✓	✓	✓		✓	✓
	2. Project	30%		✓	✓	✓	✓	✓	✓
	3. Examination	60%	✓	✓	✓	✓		✓	✓
	Total	100%							
	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Assessment is divided into three parts individual quizzes (10%), group projects (30%), and individual examinations (60%). Quizzes and examinations will test the students understanding of fundamental knowledge of productivity in construction, factors that impact productivity, and research techniques for modeling and analysis of productivity.</p> <p>Students will be divided into groups to model, analyze and implement the gained knowledge on productivity to a real case study(ies). The project requires the students to work in a team where learning outcomes are</p>								

	assessed by means of group presentations and reports. Communication skills will be tested during the project work and presentation.	
Student Study Effort Expected	Class contact:	
	▪ Lectures	39 Hrs.
	▪ Project Seminars	11 Hrs.
	Other student study effort:	
	▪ Reading of reference materials	46 Hrs.
	▪ Writing project report	24 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	<ul style="list-style-type: none"> Nunnally, S.W. (2010). Construction Methods and Management. 8th Ed., Pearson Education Inc., Upper Saddle River, New Jersey, USA. Bernold, L.E. (2013). Construction Equipment and Methods: Planning, Innovation, Safety. John Wiley & Sons Ltd, New York, NY, USA. Peurifoy, R., Schexnayder, C., Shapira, A., and Schmitt, R. (2010). Construction Planning, Equipment, and Methods. 8th Edition. McGraw-Hill Education, New York, NY, USA. Halpin, Daniel W. and Riggs, Leland S. (1992). Planning and Analysis of Construction Operations. John Wiley & Sons, New York, NY. Elwakil, E. and Zayed, T. (2018). "Construction Productivity Fuzzy Knowledge Base Management System," Canadian Journal of Civil Eng., January 06, 45(5):329-338. Jabri, A. and Zayed, T. (2017). "Agent-based modeling and simulation of earthmoving operations," J. of Automation in Construction, September, 81: 210-223. Mirahadi, F. and Zayed, T. (2016). "Simulation-Based Construction Productivity Forecast Using Neural-Network-Driven Fuzzy Reasoning," J. of Automation in Construction, May, Vol. 65, pp. 102-115. Alzraiee, H., Zayed, T., and Moselhi, O. (2015). "Dynamic Planning of Construction Activities using Hybrid Simulation," J. of Automation in Construction, Volume 49, Part B, Jan, PP. 176-192. Zayed, T. and Mohamed, E. (2014). "A Case Productivity Model for Automatic Climbing System," J. of Eng., Construction and Architectural Management, Jan., 21(1): 33-50. Zayed, T. (2009). "Stochastic Productivity Assessment of Continuous Flight Auger Piles," J. of Architectural Science Review (ASR), Australia, March, 52(1): 13-23. Zhang, C., Zayed, T., and Hammad, A. (2008). "Resource Mgmt of Bridge Deck Rehabilitation: Jacques Cartier Bridge Case Study," J. of Construction Eng. & Mgmt, ASCE, May, 134(5): 311-319. Zayed, T. and Halpin, D. (2004). "Simulation as a Tool for piles Productivity Assessment," J. of Construction Eng and Mgmt, ASCE, May/June, 130(3): 394-404. Zayed, T. and Halpin, D. (2001). "Simulation of Concrete Batch Plant Production," J. of Construction Eng. and Management, ASCE, April, 127(2): 132-141. Yi, W, and Chan, APC (2017) Effects of heat stress on construction labor productivity in Hong Kong: a case study of rebar workers. International Journal of Environmental Research and Public Health, Volume 14, Issue 9, 12 September 2017, Article number 1055, doi:10.3390/ijerph14091055 Yi, W, and Chan, APC (2015) Optimal work pattern for construction workers 	

	<p>in hot weather: a case study in Hong Kong. ASCE's Journal of Computing in Civil Engineering. http://dx.doi.org/10.1061/(ASCE)CP.1943-5487.0000419 (Accepted on 2 June 2014, published online on July 8, 2014), 05014009-1-11, Vol.29, Issue 5, 1 September 2015.</p> <ul style="list-style-type: none"> • Yi, W, and Chan, APC (2014) Critical review of labor productivity research in construction journals. Journal of Management in Engineering, doi:10.1061/(ASCE)ME.1943-5479.0000194, Vol.30, No.2, March 1, 2014, 214-225. • Yi, W, and Chan, APC (2013) Optimizing work-rest schedule for construction rebar workers in hot and humid environment. Building and Environment 61(2013) 104-113. • Chan, APC, Wong, FKW, Wong, DP, Lam EWM, and Yi, W (2012) Determining an optimal recovery time after exercising to exhaustion in a controlled climatic environment: application to construction works. Journal of Building and Environment, 56 (2012) 28-37. • Yi, W, and Chan, APC (2015) An artificial neural network model for predicting fatigue of construction workers in humid environments. 8th International Structural Engineering and Construction Conference (ISEC-08), Western Sydney University, November 2015 • Wong, JWM, Chan, APC, and Chiang, YH (2011) Construction manpower demand forecasting: a comparative study of univariate time series, multiple regression and econometric modeling techniques. Journal of Engineering, Construction and Architectural Management, Vol.18, Issue 1, 1-29. • Wong, JWM, Chan, APC, and Chiang, YH (2010) Modelling construction occupational demand: the case of Hong Kong. ASCE Journal Construction Engineering and Management, Vol. 136, No. 9, September 1, 2010, 991-1002. • Chan, APC, Wong, JWM, Chiang, YH (2004) Modelling Labour Demand at Project Level – An Empirical Study in Hong Kong, the Journal of Engineering, Design and Technology, Vol. 1, No.2, 135-150. • Chan, DWM, Chan, APC, Lam, PTI, and Lau, WK (2015) Predicting construction durations and enhancing construction productivity: a taxonomic review. Innovation in Construction, Research Journal 2015, Issue 2, 31-44. • Chan, APC, and Chan, DWM (2003) A benchmark model for construction duration in public housing developments, International Journal of Construction Management, Vol.3, No.1, 1-14. • Chan, APC, and Chan, DWM (2003) A research framework for benchmarking project construction durations, Construction Information Quarterly, The Chartered Institute of Building, Vol. 5, Issue 2, 10-15. • Chan, APC (1999) Modelling building durations in Hong Kong. The Journal of Construction Management and Economics, Volume 17, Number 2, March, 1999, 189-196. • Chan, APC and Chan, DWM (2004) Developing a benchmark model for project construction time performance in Hong Kong, Building and Environment, Vol.39, March, 339-249. • Chan, APC (2001) Time cost relationship of public sector projects in Malaysia, International Journal of Project Management, Vol. 19, No.4, 223-229.
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Subject Description Form

Subject Code	BRE666
Subject Title	Numerical Methods for Engineers
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject aims to provide students the basic concepts, methodologies and skills of solving engineering problems numerically with computers.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> find the root of an equation by bisection method and Newton-Raphson method; solve algebraic equations by Gauss elimination, LU decomposition and matrix inversion, Gauss-Seidel iteration method; apply least-squares regression and interpolating polynomials for curve-fitting and plotting experimental data; apply Newton-Cotes integration formulas for numerical integration and finite difference method for numerical differentiation; apply finite difference methods for solving ordinary and partial differential equations, including Euler's method, Runge-Kutta method, and Crank-Nicolson method. Apply statistical methods for data analysis
Subject Synopsis / Indicative Syllabus	<p>Introduction to Numerical and Statistical Methods</p> <p>Roots of non-linear equations – Bracketing method. Bisection method. Open methods. Newton-Raphson method. Secant method. Brent's method.</p> <p>Linear algebraic equations – Gauss elimination. LU Decomposition and Matrix Inversion. Gauss-seidel iteration.</p> <p>Curve fitting and interpolating – Least square regression. Linear regression. Polynomial regression. Nonlinear regression. Interpolation. Lagrange interpolating polynomials. Newton's divided-difference interpolating polynomials. Spline interpolation.</p> <p>Numerical integration and differentiation – Newton-cotes integration formulas. Trapezoidal rule. Simpson's rules. Romberg integration.</p>

	Taylor's series expansion. Richardson extrapolation. Differential equations – Euler's method. Runge-Kutta method. Systems of equations. General methods for boundary-value problems. The shooting method. Finite difference method; Explicit methods. Crank-Nicolson method. Alternating-direction implicit (ADI) scheme. Statistical methods for Building Engineers, Surveyors and Project Managers – Elementary measurements of central tendency and dispersions; Probability and probability distributions; Collection of data, sampling, sampling distributions estimation and hypothesis testing; Goodness of fit and testing of independence simple and multiple regression; Software application: SPSS							
Teaching / Learning Methodology	Teaching periods will adopt a range of methods which include lectures and tutorials. The lectures aim to provide the students fundamental concepts and principles of numerical methods. Tutorial will be used to develop students' problem solving skills. Where appropriate, the use of computer assisted learning techniques will be employed. The intention is to create an environment that encourages active learning. Students will be encouraged to apply the numerical techniques to solve practical engineering problems.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d	e	f
	1. Coursework	50%	✓	✓	✓	✓	✓	✓
	2. Examination	50%	✓	✓	✓	✓	✓	✓
	Total	100%						
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Examination and coursework will constitute 50% and 50% of the overall work of the subject respectively. The coursework mark will be based on the assessments of assignments, problem solving projects, and in-class mid-term test. Assessment methods are intended to ensure the students achieve the learning objectives.								
Student Study Effort Expected	Class contact:							
	▪ Lectures		2 x 13 = 26 Hrs.					
	▪ Tutorials		1 X 13 = 13 Hrs.					
	Other student study effort:							
	▪ Computer simulations and results analysis		6 x 7 = 42 Hrs.					
▪ Self-study		3 x 13 = 39 Hrs.						

	Total student study effort	120 Hrs.
Reading List and References	<ol style="list-style-type: none"> 1. S.C. Chapra and R.R. Canale, Numerical Methods for Engineers, McGraw-Hill, 2006. 2. J. Kiusalaas, Numerical Methods in Engineering with MATLAB, Cambridge University Press, 2010. 3. W. Dos Passos, Numerical methods, algorithms, and tools in C#, CRC press, 2010. 4. D.R. Durran, Numerical Methods for Fluid Dynamics: with Applications to Geophysics, New York, Springer, 2010. 5. D.F. Griffiths, D.J. Higham, Numerical Methods for Ordinary Differential Equations: Initial Value Problems, London, New York, Springer, 2010. 6. B.C. Cronk, <i>How to use SPSS: a step-by-step guide to analysis and interpretation</i>. Pyrczak Publishing, 2008 7. Francis Bacon in <i>Stanford Encyclopedia of Philosophy</i>. Edited by Zalta, E.N. 8. D.B. Levine, D.F. Stephan, T.C. Krehbiel, M.L. Berenson, <i>Statistics for Managers using Microsoft Excel</i>. Pearson. 2011. 9. D.P. Lindstrom (ed.) <i>Schaum's easy outlines in statistics</i>. McGraw Hill. 2002. 10. E.M. Phillips, D.S. Pugh, <i>How to get a PhD</i>. Open University Press. 2010. 11. K.R. Popper, <i>The logic of scientific discovery</i>. Hutchinson. 1968. 	

Subject Description Form

Subject Code	BRE671
Subject Title	Attendance in research seminars/workshops/conferences
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	Understand the importance and strategic value of research and development. Develop effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two academic years.</p> <p>The research seminars may or may not be organised by BRE Department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to the Research Office for custody at the end of each academic year.</p> <p>Students are recommended to complete one credit for attending seminars per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students to fulfil the research seminar credit requirement.</p>

Subject Description Form

Subject Code	BRE672
Subject Title	Attendance in research seminars/workshops/conferences
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	Understand the importance and strategic value of research and development. Develop effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two academic years.</p> <p>The research seminars may or may not be organised by BRE Department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to the Research Office for custody at the end of each academic year.</p> <p>Students are recommended to complete one credit for attending seminars per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students to fulfil the research seminar credit requirement.</p>

Subject Description Form

Subject Code	BRE673
Subject Title	Attendance in research seminars/workshops/conferences
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	Understand the importance and strategic value of research and development. Develop effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two academic years.</p> <p>The research seminars may or may not be organised by BRE Department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to the Research Office for custody at the end of each academic year.</p> <p>Students are recommended to complete one credit for attending seminars per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students to fulfil the research seminar credit requirement.</p>

Subject Description Form

Subject Code	BRE674
Subject Title	Attendance in research seminars/workshops/conferences
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	Understand the importance and strategic value of research and development. Develop effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per academic year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two academic years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two academic years.</p> <p>The research seminars may or may not be organised by BRE Department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to the Research Office for custody at the end of each academic year.</p> <p>Students are recommended to complete one credit for attending seminars per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students to fulfil the research seminar credit requirement.</p>

Subject Description Form

Subject Code	BRE675
Subject Title	Practicum
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure of the students in teaching activities and professional service.
Intended Learning Outcomes	Develop effective teaching, communication and organisation skills.
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students who are not provided with the TPS Assistantship, irrespective of funding source and mode of study, must complete two training credits before graduation.</p> <p>To earn one credit, students will be required to engage in teaching activities and/or professional service recognized by the Department.</p> <p>Students are allowed to complete these two credits any time before they graduate. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.</p> <p>For students who are required to undertake teaching supporting activities, they should be required to complete the training programmes organised by the EDC and ELC before the commencement of any teaching supporting activities.</p>
Assessment Methods	<p>Chief Supervisors are required to:</p> <ol style="list-style-type: none"> a. Ensure that the activities are structured with proper assessment and b. Submit an assessment report on the performance of the student, with details of activities undertaken and an overall grade of Pass <u>or</u> Fail.

Subject Description Form

Subject Code	BRE676
Subject Title	Practicum
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	To enhance the exposure of the students in teaching activities and professional service.
Intended Learning Outcomes	Develop effective teaching, communication and organisation skills.
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students who are not provided with the TPS Assistantship, irrespective of funding source and mode of study, must complete two training credits before graduation.</p> <p>To earn one credit, students will be required to engage in teaching activities and/or professional service recognized by the Department.</p> <p>Students are allowed to complete these two credits any time before they graduate. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.</p> <p>For students who are required to undertake teaching supporting activities, they should be required to complete the training programmes organised by the EDC and ELC before the commencement of any teaching supporting activities.</p>
Assessment Methods	<p>Chief Supervisors are required to:</p> <ol style="list-style-type: none"> a. Ensure that the activities are structured with proper assessment and b. Submit an assessment report on the performance of the student, with details of activities undertaken and an overall grade of Pass <u>or</u> Fail.

Departmental Subjects

***Civil and Environmental
Engineering***

Subject Description Form

Subject Code	CSE6010
Subject Title	Nonlinear Finite Element Analysis of Structures
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Students should possess a basic understanding of elasticity, plasticity, and linear finite element analysis of structures from first courses on these topics or through self-learning
Objectives	<p>This subject is intended to</p> <ul style="list-style-type: none"> (a) Expose students to common geometrically and materially nonlinear phenomena of civil engineering structures; (b) Equip students with a good understanding of plasticity-based constitutive modelling for steel and other materials; and (c) Provide students with a good knowledge of the concepts and techniques of the finite element method as employed in the nonlinear numerical analysis of structures under static and dynamic loads.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> a. Develop finite element models for static and dynamic problems; b. Explain clearly the stress-strain-strength of metals, concrete, rock and soils and their constitutive modeling; c. Explain clearly geometric nonlinearity and its modelling techniques; d. Conduct reliable and efficient static or dynamic nonlinear finite element analyses using a general-purpose package by informed choices of element types, boundary conditions, constitutive models, solution procedures, etc.; e. Interpret and evaluate results from nonlinear finite element analyses in a sensible manner.
Subject Synopsis / Indicative Syllabus	<p>This subject covers the following aspects:</p> <ul style="list-style-type: none"> 1. <u>Review of fundamental concepts of finite element method</u> <p>Finite element formulation by Weighted Residual Method; Iso-parametric formulation, Numerical integration; Solution by frontal solver; Solution of eigenvalue problems; Method of sub-space iterations; Types of elements.</p> <ul style="list-style-type: none"> 2. <u>Geometric nonlinearity</u> <p>Finite element vs stability function; Element with initial</p>

	<p>imperfection for second-order analysis; Newton Raphson Method; Displacement control method for tracing of equilibrium path; Snap-through and snap-back buckling. Second-order direct analysis applied to structural design.</p> <p>3. <u>Material nonlinearity and constitutive models for metals</u></p> <p>Elastic-plastic behavior of metals; Yield surfaces; Flow theory of plasticity; Associated versus non-associated plasticity; Tresca model; Von Mises model; Incremental stress-strain relationships; Tangent stiffness matrix; Brief introduction to finite element programs for solids.</p> <p>4. <u>Constitutive models for concrete</u></p> <p>Elastic-plastic behaviour of concrete; Yield surfaces for concrete; Rate effects; Drucker-Prager model; Mohr-Coulomb model; Plastic-damage model.</p> <p>5. <u>Dynamic nonlinear analysis of structures</u></p> <p><u>Linear dynamics</u>: Equations of motion; Mass matrix (lumped mass, consistent mass); Damping matrix (Rayleigh damping and modal damping); Central difference method; Newmark's method. <u>Nonlinear dynamics</u>: Incremental equations of motion; Computational errors. <u>Seismic analysis</u>: Ground motion; Seismic equations of motion; Response spectrum; Ductility demand; Capacity spectrum; Incremental dynamic analysis.</p>						
Teaching / Learning Methodology	<p>The subject is delivered mainly through lectures focused on the theory and techniques of nonlinear finite element analysis of structures. The lectures need to be supplemented by substantial self-study after class by students of reference materials recommended by subject lecturers.</p> <p>Students need to each complete a set of assignments on small numerical modeling problems. Each student also needs to undertake a numerical modeling project using a general-purpose finite element package. These modeling exercises will provide students with hands-on experience and opportunities to put theory into practice.</p>						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
			a	b	c	d	e
	1. Assignments	30%	✓	✓	✓	✓	
	2. Project report	30%				✓	✓

	3. Quiz	20%	✓	✓	✓			
	4. Oral Examination	20%				✓	✓	
	Total	100%						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The assignments are used mainly to assess the mastery of skills for developing finite element models [learning outcome (a)], for explaining material and geometric nonlinearity [learning outcomes (b) and (c)] for conducting nonlinear finite element analysis using a general-purpose finite element package [learning outcome (d)]. The in-class quizzes are used to assess learning outcomes (a), (b) and (c). The numerical modeling project, requiring the integration of skills to solve a more sophisticated physical problem using a general-purpose FE package, is an assessment that covers learning outcomes (d), and (e). The oral examination, consisting of the oral presentation of a project and a question & answer session, is for the assessment of learning outcomes (d) and (e).							
Student Study Effort Expected	Class contact:							
	▪ Lecture	39 Hrs.						
	▪ Examination							
	Other student study effort:							
	▪ Reading of reference materials	26 Hrs.						
	▪ Assignments on small modeling problems	30 Hrs.						
	▪ Numerical modeling project	40 Hrs.						
	Total student study effort		135 Hrs.					
Reading List and References	1. Books							
	<ul style="list-style-type: none">• Bhatti, M.A. (2006). Advanced topics in finite element analysis of structures: with Mathematics and Matlab Computations. John Wiley & Sons, Inc. New York.• Barbero, E.J. (2013) Finite element analysis of composite materials using ABAQUS, CRC Press/Taylor & Francis Group.• Chen, W.F. and Han, D.J. (1988). Plasticity for structural engineers. Springer-Verlag, New York.• Chopra, A.K. (2001) Dynamics of structures: theory and applications to earthquake engineering, Prentice Hall.• Clough, R.W. and Penzien, J. (1993) Dynamics of structures. McGraw-Hill Education.• Cook, R.D. (1995) Finite element modeling for stress analysis, John Wiley & Sons.• De Borst, R. Crisfield, M.A., Remmers, J.J.C. and Verhoosel, C.V. (2012) Nonlinear finite element analysis of solids and structures, 2nd							

	<p>edition, Wiley.</p> <ul style="list-style-type: none"> • Guven, I. (2006) The finite element method and applications in engineering using ANSYS, Springer. • Khennane, A. (2013) Introduction to finite element analysis using MATLAB and ABAQUS, CRC Press/Taylor & Francis Group. • Kythe, P. and Wei, D. (2004) An introduction to linear and nonlinear finite element analysis: a computation approach, Birkhauser Publisher. • Reedy, J.N. (2004) An introduction to nonlinear finite element analysis. Oxford University Press. • Smith, I.M. and Griffiths D.V. (1988), Programming the finite element method, John Wiley, 3rd edition. • Zienkiewicz, O.C. (1977) The finite element method, 3rd edition, McGraw-Hill. <p>2. Finite Element Software Available in the CEE Computer Room</p> <ul style="list-style-type: none"> • ANSYS, from ANSYS Inc, Pittsburgh, USA. • ABAQUS FEA, from Dassault Systèmes Simulia Corp, Rhode Island, USA. • NIDA, Nonlinear Integrated Design and Analysis, PolyU.
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Subject Description Form

Subject Code	CSE6011
Subject Title	Structural Performance Monitoring
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Structural dynamics
Objectives	(1) To expose students to the new and innovative health monitoring technology for sustainable infrastructure; (2) To develop an understanding of the basic theory and practical use of health monitoring systems and technology; and (3) To enable students to design and implement health monitoring technology for sustainable infrastructure.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. design appropriate and cost-effective health monitoring systems for sustainable infrastructure; b. process and interpret various types of data from a structural health monitoring system; c. evaluate structural performance based on analyzed data and other information; and d. provide the findings for the client, designer, contractor, or other relevant sectors on the safety and sustainability of the infrastructure through oral presentations and written reports.
Subject Synopsis / Indicative Syllabus	1. Introduction (1.5 weeks) Infrastructure, built environment, safety, sustainability, recent developments in health monitoring technology 2. Health monitoring system (1.5 weeks) Sensors and sensing technology, data acquisition and transmission system, data processing and control, data management system, design of health monitoring system 3. Finite element modeling (1 week) Beam model, solid model, hybrid model, model updating 4. Structural dynamics and testing (2 weeks) Basic of structural dynamics, modal testing and modal analysis 5. Monitoring of structural loadings and effects (3 weeks)

	<p>Traffic load, temperature load, wind load, other loads</p> <p>6. Structural damage detection (1 week) Vibration based methods, non-destructive testing methods</p> <p>7. Project works (3 weeks) Analysis of data from a health monitoring system or laboratory testing on a test-bed, written report, oral presentation.</p>							
Teaching / Learning Methodology	<p>Fundamental knowledge related to health monitoring of infrastructure for safety and sustainability will be presented in lectures. Real applications to some landmark infrastructure will be demonstrated in details. Assignments will help students consolidate their understanding and implementation of commonly used data processing techniques. Laboratory testing on a test-bed and real practice on some structural health monitoring systems will help students to understand the basic methods used in structural health monitoring and the challenges for the real infrastructure. Final oral presentation will train the students on presentation and communication skills.</p>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. Assignments	30%		✓	✓			
	2. Project report	40%	✓	✓	✓	✓		
	3. Project presentation	30%	✓	✓	✓	✓		
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lectures/Tutorials							30 Hrs.
	▪ Project/Laboratory/Presentation							9 Hrs.
	Other student study effort:							
	▪ Reading and studying							48 Hrs.
	▪ Completion of reports							30 Hrs.
	Total student study effort							117 Hrs.
Reading List and References	<p>Books</p> <p>1) Xu, Y.L. and Xia, Y., (2011), <i>Structural Health Monitoring of Long Span Suspension Bridges</i>, Spon Press.</p> <p>2) Boller, C., Chang, F.K. and Fujino, Y., 2009, <i>Encyclopedia of Structural Health Monitoring</i>, (Chichester: John Wiley & Sons).</p> <p>3) Clough, R.W. and Penzien, J., 1993, <i>Dynamics of Structure</i>, 2nd edition, (New York: McGraw-Hill).</p> <p>4) FHA, 2006, <i>Bridge Inspector's Reference Manual</i>, (Federal Highway Administration).</p> <p>5) Friswell, M.I. and Mottershead, J.E., 1995, <i>Finite Element Model Updating in Structural Dynamics</i>, (Boston: Kluwer Academic Publishers).</p> <p>6) Frýba, L. 1996, <i>Dynamics of Railway Bridges</i>, (Thomas Telford House).</p>							

	<p>7) Gimsing, N.J., 1997, <i>Cable Supported Bridges: Concept and Design</i>, 2nd ed., (New York: Chichester).</p> <p>8) Hellier, C.J., 2001, <i>Handbook of Nondestructive Evaluation</i>, (USA: McGraw-Hill).</p> <p>9) Karbhari, V.M. and Ansari, F., 2009, <i>Structural Health Monitoring of Civil Infrastructure Systems</i>, (Cambridge: Woodhead Publishing Limited).</p> <p>10) Maia, N.M.M., Silva, J.M.M., He, J., Lieven, N.A.J., Lin, R.M., Skingle, G.W., To, W., and Urgueira, A.P.V., 1997, <i>Theoretical and Experimental Modal Analysis</i>, (England: Research Studies Press Ltd).</p> <p>11) Mufti, A., 2001, <i>Guidelines for Structural Health Monitoring</i>, (Winnipeg: Intelligent Sensing for Innovative Structures).</p> <p>12) Rohsenow, W.M., 1988, <i>Handbook of Heat Transfer Applications</i>, (New York: McGraw-Hill).</p> <p>13) Zienjiewicz, O.C. and Taylor, R.L., 1994, <i>The Finite Element Method, Vol. 1: Basic Formulation and Linear Problems</i>, 4th ed., England, (Berkshire: McGraw-Hill).</p> <p>Papers and reports</p> <p>14) Blejwas, T.E., Feng, C.C., and Ayre, R.S., 1979, Dynamic interaction of moving vehicles and structures. <i>Journal of Sound and Vibration</i>, 67, pp.513-521.</p> <p>15) Brownjohn, J.M.W., 2007, Structural health monitoring of civil infrastructure. <i>Philosophical Transactions of the Royal Society A</i>, 365 (1851), pp. 589-622.</p> <p>16) Consolazio, G.R., Cook, R.A., McVay, M.C., Cowan, D.R. and Biggs, A.E., 2006, <i>Barge Impact Testing of the St. George Island Causeway Bridge, Phase III: Physical Testing and Data Interpretation</i>, Structural Research Report No. BC-354-RPWO-76, University of Florida.</p> <p>17) Deng, L. and Cai, C.s., 2010, Bridge sour: prediction, modeling, monitoring, and countermeasures – review. <i>Practice Periodical on Structural Design and Construction</i>, ASCE, 15(2), pp. 125-134.</p> <p>18) Doebling, S.W., Farrar, C R, Prime, M.B and Shevitz, D.W, 1996, <i>Damage Identification and Health Monitoring of Structural and Mechanical Systems from Changes in their Vibration Characteristics: A Literature Review</i>, Los Alamos National Laboratory Report LA-13070-MS.</p> <p>19) Kareem, A., 2008, Numerical simulation of wind effects: A probabilistic perspective. <i>Journal of Wind Engineering and Industrial Aerodynamics</i>, 96(10-11), pp.1472-1497.</p> <p>20) Ko J.M. and Ni Y.Q., 2005, Technology developments in structural health monitoring of large-scale bridges. <i>Engineering Structures</i>, ASCE, 27, pp. 1715-1725.</p> <p>21) Ni, Y.Q., Xia, Y., Liao, W.Y. and Ko, J.M., (2009), "Technology Innovation in Developing the Structural Health Monitoring System for Guangzhou New TV Tower", <i>Structural Control and Health Monitoring</i>, 16(1), 73-98.</p> <p>22) Song, H.W. and Saraswathy, V., 2007, Corrosion monitoring of reinforced concrete structures – a review. <i>International Journal of Electrochemical Science</i>, 2, pp. 1-28.</p> <p>23) Xu, Y.L., 2008, Making good use of structural health monitoring systems: Hong Kong's Experience. In <i>Proceedings of The Second International Forum on Advances in Structural Engineering, Structural Disaster Prevention, Monitoring and Control</i>, Dalian, China, pp. 159-198.</p>
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Subject Description Form

Subject Code	CSE6012
Subject Title	Advances in Geotechnical and Pavement Engineering
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	<p><u>Recommended background knowledge:</u></p> <p>Students should have a knowledge and understanding of engineering mathematics, engineering mechanics, soil mechanics, and foundation engineering consistent with undergraduate level study in civil engineering.</p>
Objectives	<ol style="list-style-type: none"> 1. To provide students with the knowledge about the fundamental properties and behaviour of earth materials, mathematical models, and methods of analysis for different conditions. 2. To provide students with in-depth analysis and design of common geotechnical structures and solutions to real problems. 3. To provide students with practical knowledge of pavement material and pavement behavioural analysis
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able:</p> <ol style="list-style-type: none"> a. to apply the knowledge about the behaviour of earth materials and their constitutive models in geotechnical analyses; b. to apply advanced pavement knowledge in design and analysis of pavements c. to perform critical thinking on design methods and solutions; and d. to understand the performance of geotechnical structures.
Subject Synopsis / Indicative Syllabus	<p><u>Keyword Syllabus</u></p> <p>i) <u>Geotechnical testing and soil behaviour (2.5 weeks)</u> Conventional and advanced lab/field testing in geotechnics, Introduction to centrifuge modelling and particle image velocimetry, Mechanical behavior of soils.</p> <p>ii) <u>Constitutive modeling of soils (2.5 weeks)</u> Introduction of elasticity and plasticity; Nonlinear stress dependent elastic model; Mohr-Coulomb model; Cam-clay and Modified Cam-clay models; advances of soil modeling.</p> <p>iii) <u>Advances in geotechnical applications (2 weeks)</u> Advances in slope stability analysis, foundation (pile group/piled raft) analysis, Uncertainty and reliability approaches in geotechnical</p>

	<p>engineering.</p> <p>iv) <u>Pavement structure and materials (1 week)</u> Introduction to pavement type and structure; rheological properties and characterization of bitumen and bituminous materials.</p> <p>v) <u>Mechanical models of bituminous pavements (3 weeks)</u> Mechanical models of bituminous mixtures; pavement temperature prediction; dynamic traffic loads, pavement responses and distress evolution.</p> <p>vi) <u>Pavement condition and evaluation (2 weeks)</u> Pavement functional properties; pavement structural properties; non-destructive pavement evaluation techniques, such as falling weight deflectometer and ground penetration radar.</p>							
Teaching / Learning Methodology	<p>1. Lectures to deliver teaching materials.</p> <p>2. Journal papers on new methods, advanced techniques or basic theory.</p> <p>3. Assignments related to the subject contents.</p> <p>4. Project reports</p>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. Continuous Assignment	50%	✓	✓	✓	✓		
	2. Individual report on a special study topic	50%	✓	✓	✓	✓		
	Total	100%						
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Continuous assessment is based on assignment/quiz/test/project paper for all lectures (50%).</p> <p>Each student shall submit an individual report on a special study topic which will be given by a lecturer in his field (50%).</p> <p>Students must attain at least Grade D in the coursework and continuous assessment in order to attain a passing grade in the overall result.</p>								
Student Study Effort Expected	Class contact:							
	▪ Lectures		39 Hrs.					
	▪ Examination		--					
	Other student study effort:							
▪ Reading of reference materials		36 Hrs.						

	▪ Assignments	30 Hrs.
	▪ Project	30 Hrs.
	Total student study effort	135 Hrs.
Reading List and References	<p><u>Books</u></p> <ul style="list-style-type: none"> • Chau, K.T. (2013) Analytic Methods in Geomechanics, CRC Press, Boca Raton. • Chen, W.F., <i>Limit Analysis and Soil Plasticity</i>, Elsevier, (1975). • Cheng Y.M. and Lau C.K., <i>Soil Slope Stability Analysis and Stabilization – New methods and insights</i>, 2nd edition, Francis & Taylors (2014). • Fleming, Weltman, Randolph and Elson, <i>Piling Engineering</i>, 3rd edition, Taylors and Francis (2009). • Muir Wood, David, "Soil Behaviour and Critical State Soil Mechanics", Cambridge University Press, (1990) • Potts, D.M. and Zdravkovic, L. <i>Finite Element Analysis in Geotechnical Engineering – Theory</i>, Thomas Telford Publishing Ltd, U.K. (ISBN 0 7277 2753 2), (1999). • Shukla, Sanjay Kumar and Jian-Hua Yin (2006). "Fundamentals of Geosynthetic Engineering", published by A.A. Balkema Publishers Taylor & Francis, The Netherlands. (450 pages, 239 illustrations, 42 tables, ISBN 0415 39444 9). • Achenbach, J.D. <i>Wave Propagation in Elastic Solids</i>. North-Holland (1987). Huang Y. H. 2003. <i>Pavement Analysis and Design</i>, 2nd edition. Pearson Prentice Hall, Upper Saddle River, NJ. • Roberts, Freddy L., Prithvi S. Kandhal, E. Ray Brown, Dah-Yinn Lee, and Thomas W. Kennedy. "Hot Mix Asphalt Materials, Mixture Design and Construction." (1996). • Al-Qadi, I.L. and S. Lahouar, "Measuring Layer Thickness with GPR-Theory to Practice," <i>Construction and Building Materials</i>, Vol. 19, 2005, pp. 763-772. • Lytton, R.L., "Back calculation of Pavement Layer Properties", <i>Nondestructive Testing of Pavement and Back calculation of Moduli</i>, American Society of Testing and Materials Standard Technical Publication 1026, A.J. Bush III and G.Y. Baladi, Eds., Philadelphia, PA, 1989, pp. 7-38. <p><u>Journals</u></p> <ul style="list-style-type: none"> • Canadian Geotechnical Journal • Computers and Geotechnics • Geotechnique • Journal of Geotechnical and Geoenvironmental Engineering, The American Society of Civil Engineers • Soils and Foundations • Rock Mechanics and Rock Engineering • International Journal of Rock Mechanics and Mining Sciences • International Journal of Pavement Engineering 	

	<ul style="list-style-type: none"> • Transportation Research Record <p><u>Manuals</u></p> <ul style="list-style-type: none"> • Guide to Retaining Wall Construction (1993), Geotechnical Control Office, (GEO), Hong Kong Government. • Review of Design Methods for Excavations (1990), Geotechnical Control Office (GEO), Hong Kong Government. • Foundation Design and Construction, GEO Publication No. 1/2006, Geotechnical Control Office, (GEO), Hong Kong Government. • Hong Kong Foundation Handbook, Housing Department, 2011, Hong Kong Housing Authority.
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Subject Description Form

Subject Code	CSE6013
Subject Title	Life Cycle Performance Management of Concrete Infrastructure
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Students should have fundamental knowledge about concrete materials and design of concrete structures.
Objectives	<p>This subject is intended to</p> <ul style="list-style-type: none"> (a) Provide students with holistic understanding of the life cycle performance management strategy of concrete infrastructure; (b) Equip students with a good understanding of various deterioration mechanisms of concrete materials and reinforced concrete structures under mechanical and environmental actions; (c) Equip students with knowledge about the inspection and diagnosis of various damages in concrete infrastructure; (d) Equip students with knowledge on the assessment and prediction of the chronological deterioration of the structural performance of concrete structures; (e) Facilitate students with knowledge about the advanced repair and strengthening technologies for deteriorating concrete structures. (f) Facilitate students with knowledge about the life-end strategy of concrete infrastructure and construction waste management.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able:</p> <ul style="list-style-type: none"> a. to achieve an in-depth understanding of life-cycle performance management strategy of concrete infrastructure and the significance of implementing this strategy in pursuing the sustainability of concrete infrastructure; b. to grasp systematic knowledge on inspecting, diagnosing and monitoring the material and structural deterioration of concrete infrastructure; c. to correctly interpret the inspecting and diagnosing results and to conduct accurate assessment on the structural performance of deteriorating concrete structures and predict their future behaviour; d. to implement modern repair and strengthening technology for upgrading deteriorated concrete structures; e. to hold know-how on the recycling and management of construction wastes.
Subject Synopsis /	This subject covers the following contents:

Indicative Syllabus	<div><div>1. <u>Framework for life-cycle performance management</u> Infrastructure sustainability, fundamental principles of life cycle management, limit state design, life cycle-based design, life cycle cost analysis, state-of-the-art of the life cycle management technologies.</div><div>2. <u>Deterioration mechanisms of concrete materials and concrete structures</u> Concrete spalling, efflorescence and leaching of concrete, steel corrosion, chemical attack, frost damage, alkali aggregate reaction, surface wearing, fatigue failure, seismic damage.</div><div>3. <u>Diagnosis, inspection and performance assessment</u> Inspection and diagnosis, non-destructive/destructive testing, structural health monitoring, performance requirement, initial/detailed assessment, finite element modeling, expert system, residual service life prediction, probability-based approach.</div><div>4. <u>Repair and strengthening</u> Repair of concrete cracks, surface coating, electro-chemical repair, structural strengthening methods, externally, bonded fiber reinforced polymer (FRP) technique including flexural strengthening, shear strengthening and seismic retrofit.</div><div>5. <u>Life-end strategies and environmental issues</u> Concrete recycling, recycling of glass, carbon footprint evaluation</div><div>6. <u>Exemplary life cycle performance management tools</u> Bridge management, building management, port structure management, pavement management, tunnel management.</div></div>						
Teaching / Learning Methodology	<div>The subject is delivered mainly using lectures which are focused on all relevant technical elements of the life cycle performance management of concrete structures. The lectures need to be supplemented by substantial self-study after class by students of reference materials and other up-to-date technical reports/journal papers recommended by the lecturer(s).</div> <div>The students need to complete a set of assignments and an oral examination of the group reports at the semester end.</div>						
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
			a	b	c	d	e

Outcomes	1. Assignments	50%	✓	✓	✓	✓	✓	
	2. Quiz	20%	✓	✓	✓	✓	✓	
	3. Project Report and Oral Examination	30%	✓	✓	✓	✓	✓	
	Total	100%						
	Students must attain at least grade D in both coursework and final examination assessments (whenever applicable) in order to attain a passing grade in the overall result. The students will be assessed with two components, i.e. 1. assignments, 2. an oral examination of the group report at the end of the semester. The students will be required to conduct extensive reading after the lecture to complete a set of assignments. Each assignment is designed to cover a particular technical aspect of the life cycle performance management system of concrete structures. Hence, they are considered to be highly effective in achieving the intended learning outcomes a), b), c), d), and e). Moreover, an oral examination is designed to assess the students' understanding on the basic concepts as well as the practice of the life cycle performance management on concrete infrastructure, and is effective to achieve all the intended learning outcomes.							
Student Study Effort Expected	Class contact:							
	▪ Lectures		39 Hrs.					
	▪ Examination							
	Other student study effort:							
	▪ Reading of reference materials		26 Hrs.					
	▪ Assignments on small modeling problems		30 Hrs.					
	▪ Numerical modeling project		40 Hrs.					
	Total student study effort		135 Hrs.					
Reading List and References	• Books (1) Hitoshi Furuta, Dan, M. Frangopol and Mitsuyoshi Akiyama, Life-Cycle of Structural Systems: Design, Assessment, Maintenance and Management, CRC Press, 2014, ISBN 9781138001206 (2) Gjølry, O., Durability Design of Concrete Structures in Severe Environments, CRC Press, ISBN 9781466587298, 2013. (3) Teng, J.G., Chen, J.F., Smith, S.T. and Lam, L., FRP-Strengthened RC Structures, ISBN: 978-0-471-48706-7, Wiley, 2001.							
	• Codes of Practice (1) <i>fib</i> Model Code for Concrete Structures, Ernst & Sohn, 2010, Lausanne, Switzerland (2) ISO FDIS 16311-1, Maintenance and repair of concrete structures – Part 1: General principles. (3) ISO FDIS 16311-2, Maintenance and repair of concrete structures –							

	<p>Part 2: Assessment of existing concrete structures.</p> <p>(4) ISO FDIS 16311-3, Maintenance and repair of concrete structures – Part 3: Design of repairs and prevention.</p> <p>(5) ISO FDIS 16311-4, Maintenance and repair of concrete structures – Part 4: Execution of repairs and prevention.</p> <p>(6) Japan Society of Civil Engineer, Standard Specification for Concrete Structures-2001, “Maintenance”.</p> <p>• Journals</p> <p>(1) Structural and Infrastructure Engineering: Maintenance, Management, Life Cycle Design and Performance, Taloy & Francis.</p>
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Subject Description Form

Subject Code	CSE6014
Subject Title	Environmental Fluid Mechanics
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	<u>Recommended background knowledge:</u> Students should have a knowledge and understanding of: undergraduate level of studies in engineering or science; and elements on coding using Matlab, Python, Fortran or equivalent programming languages.
Objectives	<ol style="list-style-type: none"> 1. To provide students a better understanding of the mechanisms leading to various types of water/air dispersion behaviour. 2. To provide students a rational basis for devising water/air quality analysis strategies. 3. To provide students with the knowledge about the different numerical modelling & data analysis approaches. 4. To provide students with in-depth analysis ability of dispersion processes in different contexts.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able:</p> <ol style="list-style-type: none"> a. to formulate and develop mathematical models for water/air quality prediction. b. to devise suitable measures for water/air quality applications in different research fields. c. to apply knowledge in the analysis of data and incorporate the result into aqueous reactor for application; and d. to perform critical thinking on design/research methods and solutions.
Subject Synopsis / Indicative Syllabus	<p><u>Keyword Syllabus</u></p> <ol style="list-style-type: none"> 1. Mass transport processes. Modelling approaches and solutions (15 Hrs) Review of Diffusion and Dispersion Processes. The turbulent advection-diffusion equations and its applications for air/water quality. Dispersion of heavy/light particles in water and air: the role of buoyancy and inertia. Transport of reactive materials: models and solutions. 2. Numerical models for water and air quality and data analysis (12 Hrs) Elements of numerical methods: finite difference, finite volume and finite elements; meshless methods. Overview of modelling approaches: Eulerian and Lagrangian models. Data analysis: analysis of the velocity fields, Eulerian and Lagrangian measures of fluid mixing.

	<p>3. Applications: Water and air (12 Hrs)</p> <p>Dispersion in natural water bodies and pressurized flows: Rivers mixing, mixing in Estuaries and coastal water induced by tidal, wind and wave currents.</p> <p>Dispersion in air: applications to atmospheric pollution and indoor air quality, Gaussian models and Lagrangian models; transport of fine particles.</p>							
Teaching / Learning Methodology	<p>1. Lectures to deliver teaching materials. Lectures will provide fundamental methods and practical approaches to the students.</p> <p>2. Students should explore journal papers on new methods, advanced techniques or basic theory related to the subject content and their study background & research field.</p> <p>3. Tutorials will provide chances to the students to discuss their individual applications in detail with the lecturer in person. This is useful for best fitting the needs for the students with different backgrounds. The reports will relate to the subject contents and students' background.</p> <p>4. The students will be asked to directly apply the methodologies of analysis presented during the lectures by preparing their own scripts and codes (Matlab, python, Fortran, or others proposed by the students).</p>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. Assignments	50%	✓	✓				
	2. Project report	50%			✓	✓		
	Total	100%						
	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Continuous assessment is based on</p> <p>1) Assignments based on calculations of water/air mixing applications (50%).</p> <p>2) Report on individual student project, based on numerical simulations performed using open source models and/or script developed by the students using Matlab, python or equivalent programming languages (50%).</p>							
Student Study Effort Expected	Class contact:							
	▪ Lectures and Tutorials		39 Hrs.					
	▪ Examination		--					
	Other student study effort:							

	▪ Reading of reference materials	36 Hrs.
	▪ Assignments	30 Hrs.
	▪ Project	30 Hrs.
	Total student study effort	135 Hrs.
Reading List and References	<p><u>Books</u></p> <ul style="list-style-type: none"> • Fischer, et al., Mixing in Inland and Coastal Waters, Academic Press, 1979. • Tennekes and Lumley, A First Course in Turbulence, The MIT Press, 1972. • Fernando, Harindra Joseph, ed. Handbook of environmental fluid dynamics, volume one: overview and fundamentals. CRC press, 2012. • Fernando, Harindra Joseph, ed. Handbook of Environmental Fluid Dynamics, Volume Two: Systems, Pollution, Modeling, and Measurements. CRC press, 2012. • Lynch, Daniel R., et al. Particles in the coastal ocean: Theory and applications. Cambridge University Press, 2015. <p><u>Journals</u></p> <p>Journal of Geophysical Research</p> <p>Water Resources Research</p> <p>Environmental Science and Technology</p> <p>Journal of Fluid Mechanics</p> <p>Journal of Environmental Engineering, ASCE</p> <p>Atmospheric Environment</p> <p>Journal of Aerosol Science</p>	

Subject Description Form

Subject Code	CSE6015
Subject Title	Transportation Optimization and Simulation Methods
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Students should have fundamental knowledge about mathematics and computation methods.
Objectives	This subject is intended to introduce a broad range of optimization and simulation methods for construction and transportation applications; and equip students with knowledge of applying the skills learned in this class to model and solve real- world problems in construction and transportation.
Intended Learning Outcomes	Upon completion of the subject, students will be able: <ul style="list-style-type: none"> a. to appreciate the need for a systematic approach for modeling different applications in construction and transportation; b. to equip students with a good understanding of the fundamentals in formulating and solving real-world problems in the field of construction and transportation; c. to demonstrate the capability to apply the skills learned in this course to model and solve real-world construction and transportation problems; d. to demonstrate the capability to write a technical report/paper and communicate the results of their solution approach to other engineering professionals
Subject Synopsis / Indicative Syllabus	<p>This subject covers the following contents:</p> <ol style="list-style-type: none"> 1. <u>Fundamentals</u> Basic principles in systems analysis applied to construction and transportation; Basic theory of optimization and simulation methods; Unconstrained and constrained optimization problems; Introduction to stochastic and multi-objective optimization problems 2. <u>Network Flow Optimization</u> Shortest path problems; vehicle routing problems; Traffic assignment problems (user equilibrium versus system optimal); Stochastic traffic assignment problems; Traffic assignment algorithms 3. <u>Network Design Problems</u> Traffic paradoxes (Braess paradox, stochastic paradox, capacity paradox, etc.); Game theory; Bi-level mathematical programs; Deterministic and stochastic network design problems; Iterative- optimization-assignment method; Sensitivity-based analysis method; Global optimization method; Metaheuristics 4. <u>Complex System Problems</u> Agent-based modeling; System dynamics; System of systems; Network theory

	<p>5. <u>Advanced Topics</u> Supernetworks; Dynamic traffic assignment; Transit assignment; Reliability and vulnerability analysis</p>																																												
Teaching / Learning Methodology	<p>The subject is delivered mainly using lectures which are focused on optimization methods for formulating and solving real-world construction and transportation problems. The lectures need to be supplemented by substantial self-study after class by students of reference materials and other up-to-date technical reports/journal papers recommended by the lecturer(s).</p> <p>The students need to complete a set of assignments and an individual project and presentation.</p>																																												
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="6">Intended subject learning outcomes to be assessed</th></tr> <tr> <th>a</th><th>b</th><th>c</th><th>d</th><th></th><th></th></tr> </thead> <tbody> <tr> <td>1. Assignments</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr> <tr> <td>2. Project Report and Presentation</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr> <tr> <td>Total</td><td>100%</td><td colspan="6"></td></tr> </tbody> </table> <p>The students will be assessed with two components, i.e. 1. assignments, 2. Written individual project report and oral presentation at the end of the semester. The students will be required to conduct extensive reading after the lecture to complete a set of assignments. Each assignment is designed to cover a particular technical aspect of data analysis. Moreover, an individual project is designed to assess the students' understanding on the critical assessment and effective communication of the results of data analysis in solving real world problems. Hence, the students are considered to be highly effective in achieving the intended learning outcomes a, b, c and d.</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						a	b	c	d			1. Assignments	50%	✓	✓	✓				2. Project Report and Presentation	50%	✓	✓	✓	✓			Total	100%												
Specific assessment methods/tasks	% weighting			Intended subject learning outcomes to be assessed																																									
		a	b	c	d																																								
1. Assignments	50%	✓	✓	✓																																									
2. Project Report and Presentation	50%	✓	✓	✓	✓																																								
Total	100%																																												
Student Study Effort Expected	<p>Class contact:</p> <ul style="list-style-type: none"> Lectures Examination <p>Other student study effort:</p> <ul style="list-style-type: none"> Reading of reference materials Assignments Individual project <p>Total student study effort</p>						<p>39 Hrs.</p> <p></p> <p></p> <p>26 Hrs.</p> <p>30 Hrs.</p> <p>40 Hrs.</p> <p>135 Hrs.</p>																																						
Reading List and References	<p>Books</p> <p>(1) Anderson, D.R., Sweeney, D.J., Williams, T.A., Camm, J.D., Martin, K., 2012. An Introduction to Management Science: Quantitative Approaches to Decision Making. Revised 13th Edition, South-Western Cengage Learning, Mason, OH, USA.</p> <p>(2) Ahuja, R.K., Magnanti, T.L., Orlin, J.B., 1993. Network Flows, Prentice Hall.</p> <p>(3) ReVelle, C.S., Whitlatch, E.E., Wright, J.R., 2004. Civil and Environmental</p>																																												

	<p>Systems Engineering, 2nd Edition, Prentice Hall.</p> <p>(4) Sheffi, Y., 1985. Urban Transportation Networks: Equilibrium Analysis with Mathematical Programming Methods, Prentice Hall.</p> <p>(5) Bell, M.G.H., Iida, Y., 1997. Transportation Network Analysis, John Wiley & Sons, Inc.</p> <p>(6) Nagurney, A., 1999. Network Economics: A Variational Inequality Approach, Kluwer Academic Publishing.</p> <p>(7) Nagurney, A., Dong, J., 2002. Supernetworks Decision-Making for the Information Age, Edward Elgar Publishing Limited, Northampton, Massachusetts, USA.</p> <p>(8) Wilensky, U., Rand, W., 2015. An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo, The MIT Press.</p> <p>Journals</p> <p>(1) Transportmetrica A: Transport Science, http://www.tandfonline.com/toc/ttra21/current</p> <p>(2) Transportmetrica B: Transport Dynamics, http://www.tandfonline.com/loi/ttrb20</p> <p>(3) Transportation Research Part B: Methodological, https://www.journals.elsevier.com/transportation-research-part-b-methodological</p> <p>(4) Transportation Research Part C: Emerging Technologies, https://www.journals.elsevier.com/transportation-research-part-c-emerging-technologies/</p> <p>(5) Transportation Research Part E: Logistics and Transportation Review, https://www.journals.elsevier.com/transportation-research-part-e-logistics-and-transportation-review/</p> <p>(6) Travel Behaviour and Society, https://www.journals.elsevier.com/travel-behaviour-and-society/</p> <p>(7) International Journal of Sustainable Transportation, http://www.tandfonline.com/loi/ujst20</p> <p>(8) Journal of Computing in Civil Engineering, http://ascelibrary.org/journal/jccee5</p> <p>(9) Environmental Modelling & Software, https://www.journals.elsevier.com/environmental-modelling-and-software</p> <p>(10) Computer, Environment and Urban Systems, https://www.journals.elsevier.com/computers-environment-and-urban-systems/</p>
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Subject Description Form

Subject Code	CSE6016
Subject Title	Probability, Statistics, and Machine Learning for Engineers
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to introduce a broad range of statistical and machine learning methods for civil engineering applications; and equip students with knowledge of applying the skills learned to quantitatively model and solve real-world problems in civil engineering.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> Appreciate the need for a quantitative approach for modelling different applications in civil engineering. Understand the conceptual foundations of probabilistic and statistical models, and their broad applications in civil engineering. Understand the mathematical foundations of different types of machine learning methods and can differentiate the suitability of each method in various applications. Demonstrate the capability to quantitatively model and solve real-world engineering problems using statistical and machine learning methods.
Subject Synopsis / Indicative Syllabus	<ol style="list-style-type: none"> Introduction (1 week) An overview of the statistical and machine learning methods in engineering, history, real-world applications, and future development Probability and statistics (6 weeks) Fundamental concepts of probabilistic/statistical models including random variables, probability distributions, and count and discrete dependent variable models. Further application of the models to a variety of contexts in civil engineering such as risk and reliability analysis for designing infrastructure. Machine learning (6 weeks) The machine learning basics, including the concept of learning (e.g., learnability, Occam's razor), supervised learning (e.g., perceptron, SVM, decision tree, linear regression, logistic regression), unsupervised learning (e.g., k-means, hierarchical clustering), reinforcement learning (e.g., Q-learning), and statistical learning (e.g., graphical models).
Teaching / Learning Methodology	A series of lectures and tutorials will be provided to introduce the principles of knowledge of the application of statistics and machine learning. Students will be required to relate the lecture materials with assignments and through homework, lab reports and quizzes. Reading and studying, e-Learning by students, including literature review and information searching, is required to achieve all the intended learning outcomes of the subject.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	Assignments	30	✓	✓	✓	✓		
	Projects	30	✓			✓		
	Quizzes	40	✓	✓	✓	✓		
	Total	100%						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:							
	Student will be assessed with continuous assessment. The continuous assessment consists of a set of assignments (30%), project (30%), and quizzes (40%).							
	Assignments: assessment of the studies with respect to the understanding of the relevant subject matters, including the principles, methodologies, and techniques, by providing answers to the assignment questions.							
	Projects: assessment of the ability to solve real-world problems by using learned techniques and developing practical solutions.							
	Quizzes: assessment of students' understanding of the relevant subject matters including the principles, concepts, methodologies, and techniques by proving answers to the questions.							
	A letter grading system will be used to assess students' performance. Students must attain at least a grade of D in the final grade to achieve a passing grade.							
Student Study Effort Expected	Class contact:							
	▪ Lectures / Tutorials		39 Hrs.					
	Other student study effort:							
	▪ Course work		39 Hrs.					
	▪ Reading and studying, e-Learning		39 Hrs.					
	Total student study effort		117 Hrs.					
Reading List and References	Reference Textbooks:							
	(1) Ang, A. and Tang, W.H. (2007) Probability Concepts in Engineering – Emphasis on Applications to Civil and Environmental Engineering, 2 nd Edition, John Wiley & Sons.							
	(2) Washington, S.P., Karlatftis, M.D., Mannering, F.L., Anastasopoulos, P. (2020) Statistical and Econometric Methods for Transportation Data Analysis. 3 rd Edition, Chapman & Hall/CRC.							
	(3) Mitchell, T. (1997) Machine Learning. McGraw Hill. http://www.cs.cmu.edu/~tom/mlbook.html							
	(4) Bishop, B. (2006) Pattern Recognition and Machine Learning. Springer.							

Subject Description Form

Subject Code	CSE6017
Subject Title	Turbulent Flow and Modelling
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Recommended background knowledge: Students should have a basic study background of fluid mechanics and/ or hydraulics; and elements on coding using Matlab, Python, Fortran or equivalent programming languages.
Objectives	<ol style="list-style-type: none"> 1. To provide students a better understanding of the main aspect of turbulent flows in terms of momentum, energy and mass transport. 2. To provide students a rational basis for devising turbulent flow analysis strategies. 3. To provide students with the knowledge about the different numerical modelling & data analysis approaches. 4. To provide students with in-depth analysis ability of turbulent flows in different contexts.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able:</p> <ol style="list-style-type: none"> a. to formulate and develop mathematical models for turbulent flow prediction. b. to apply knowledge in the analysis of vorticity and energy budgets for turbulent flows; and c. to perform critical thinking on design/research methods and solutions to be applied to their research fields
Subject Synopsis / Indicative Syllabus	<p><u>Keyword Syllabus</u></p> <ol style="list-style-type: none"> 1) <u>Fundamentals (6 hrs)</u> The nature of turbulence and its origin, lengths scales in turbulent flows, the statistical description of turbulence 2) <u>Turbulent transport of momentum and energy (9 hrs)</u> Reynolds equation, Kinetic energy budget and the energy cascades, vorticity dynamics, Free shear flows, wall bounded flows 3) <u>Turbulence modelling and simulations (9 hrs)</u> Introduction to the different turbulent modelling approaches (DNS, LES, RANS); turbulent viscosity models (one-equation; two-equations models); Reynolds stress models 4) <u>Turbulent flows analysis (6 hrs)</u> Coherent flow structures, 2D turbulence; spectral analysis of turbulent flows

	5) <u>Applications (9 hrs)</u> Showcase of different turbulent flows applications; geophysical turbulence; indoor turbulent air circulation; aerodynamic applications (wind turbine; hydraulic and gas turbines)							
Teaching / Learning Methodology	1. Lectures to deliver teaching materials. Lectures will provide fundamental methods and practical approaches to the students. 2. Students should explore journal papers on new methods, advanced techniques or basic theory related to the subject content and their study background & research field. 3. Tutorials will provide chances to the students to discuss their individual applications in detail with the lecturer in person. This is useful for best fitting the needs for the students with different backgrounds. The reports will relate to the subject contents and students background. 4. The students will be asked to directly apply the methodologies of analysis presented during the lectures by preparing their own scripts and codes (Matlab, python, Fortran, or others proposed by the students).							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c			
	1. Assignments	50%	✓	✓	✓			
	2. Project report	50%	✓	✓	✓			
	Total	100%						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Continuous assessment is based on 1) Assignments on simple turbulent flows modelling and data analysis (50%). 2) Report on individual student project (50%).							
Student Study Effort Expected	Class contact:							
	▪ Lectures / Tutorials		39 Hrs.					
	▪ Examination		-					
	Other student study effort:							
	▪ Reading of reference materials		36 Hrs.					
	▪ Assignments		30 Hrs.					
	▪ project		30 Hrs.					
	Total student study effort		135 Hrs.					
Reading List and References	<u>Books</u> Pope, S. B. (2000). Turbulent Flows. Cambridge: Cambridge University Press. Wilcox, D. C. (1998). Turbulence modeling for CFD (Vol. 2, pp. 103-217). La Canada, CA: DCW industries.							

	<p>Tsinober, A. (2001). An informal introduction to turbulence (Vol. 63). Springer Science & Business Media.</p> <p><u>Journals</u></p> <p>Journal of Fluid Mechanics</p> <p>Water Resources Research</p> <p>Physical Review Letters</p> <p>Physical Review Fluids</p>
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Subject Description Form

Subject Code	CSE6721
Subject Title	Research Seminar 1
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Students are recommended to complete one credit per year (for Full-time students) or per two years (for Part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for Full-time students) or per two years (for Part-time students) to fulfil the research seminar credit requirement.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to Departmental General Office (for those admitted from the 2018/19 cohort onwards) or to Graduate School (for those admitted in or before the 2017/18 cohort) for custody at the end of each academic year.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	CSE6722
Subject Title	Research Seminar 2
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Students are recommended to complete one credit per year (for Full-time students) or per two years (for Part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for Full-time students) or per two years (for Part-time students) to fulfil the research seminar credit requirement.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to Departmental General Office (for those admitted from the 2018/19 cohort onwards) or to Graduate School (for those admitted in or before the 2017/18 cohort) for custody at the end of each academic year.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	CSE6723
Subject Title	Research Seminar 3
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities
Subject Synopsis / Indicative Syllabus	<p>Full-time/Part-time students are required to attend at least 10 research seminars per semester, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p> <p>Each PhD student needs to give one research seminar, which should be comprehensible to a non-specialist. The seminar should last about 20 minutes, followed by Q&A for around 10 minutes.</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to Departmental General Office (for those admitted from the 2018/19 cohort onwards) or to Graduate School (for those admitted in or before the 2017/18 cohort) for custody at the end of the semester.</p> <p>Departmental Research Committee should assign academic staff(s) to evaluate students' public seminars, with a pass/fail assessment.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	CSE6724
Subject Title	Research Seminar 4
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Students are recommended to complete one credit per year (for Full-time students) or per two years (for Part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for Full-time students) or per two years (for Part-time students) to fulfil the research seminar credit requirement.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. Students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to Departmental General Office (for those admitted from the 2018/19 cohort onwards) or to Graduate School (for those admitted in or before the 2017/18 cohort) for custody at the end of each academic year.
Reading List and References	Nil

Subject Description Form

Subject Code	CSE6710
Subject Title	Practicum 1
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure of students in teaching and academic related activities
Intended Learning Outcomes	To develop advanced and effective teaching and communication skills
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students, irrespective of funding source and mode of study, must complete two training credits before thesis submission. To earn one credit, students will be required to engage in teaching activities/professional service assigned by the HoD/DoS or his/her delegate for 6 hours/week in any 13-week semester.</p> <p>Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor. Stipend recipients are not allowed to fulfill part of their departmental training requirement through the completion of these compulsory training credits.</p> <p>PhD students who will undertake teaching support activities must complete the following training programmes before the commencement of any teaching support activities:</p> <ol style="list-style-type: none"> 1. Becoming an Effective Teaching Assistant (BETA) organised by the Educational Development Centre; AND 2. CEE in-house Teaching Assistant Training; AND 3. Training programmes organized by English Language Centre/Chinese Language Centre (if required).
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to:</p> <ol style="list-style-type: none"> a. ensure that the activities are structured and can be assessed properly; b. submit, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall assessment grade of Pass or Fail.
Reading List and References	Nil

Subject Description Form

Subject Code	CSE6711
Subject Title	Practicum 2
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure of students in teaching and academic related activities
Intended Learning Outcomes	To develop advanced and effective teaching and communication skills
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students, irrespective of funding source and mode of study, must complete two training credits before thesis submission. To earn one credit, students will be required to engage in teaching activities/professional service assigned by the HoD/DoS or his/her delegate for 6 hours/week in any 13-week semester.</p> <p>Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor. Stipend recipients are not allowed to fulfill part of their departmental training requirement through the completion of these compulsory training credits.</p> <p>PhD students who will undertake teaching support activities must complete the following training programmes before the commencement of any teaching support activities:</p> <ol style="list-style-type: none"> 1. Becoming an Effective Teaching Assistant (BETA) organised by the Educational Development Centre; AND 2. CEE in-house Teaching Assistant Training; AND 3. Training programmes organized by English Language Centre/Chinese Language Centre (if required).
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to:</p> <ol style="list-style-type: none"> a. ensure that the activities are structured and can be assessed properly; b. submit, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall assessment grade of Pass or Fail.
Reading List and References	Nil

Departmental Subjects

Land Surveying and Geo-Informatics

Subject Description Form

Subject Code	LSGI631
Subject Title	Attendance in Research Seminars/Workshops/Conferences I
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students are recommended to complete one credit per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the research seminar credit requirement.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	LSGI632
Subject Title	Attendance in Research Seminars/Workshops/Conferences II
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students are recommended to complete one credit per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the research seminar credit requirement.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	LSGI633
Subject Title	Attendance in Research Seminars/Workshops/Conferences III
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students are recommended to complete one credit per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the research seminar credit requirement.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	LSGI634
Subject Title	Attendance in Research Seminars/Workshops/Conferences IV
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure and horizon of the students in research and other related areas.
Intended Learning Outcomes	To develop advanced and effective communication skills for both academic and non-academic communities.
Subject Synopsis / Indicative Syllabus	<p>Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. RPg students should discuss with their Chief Supervisors the relevance and suitability of the seminars before attending the seminars. The scope of a seminar attended by an RPg student should have significant research value to his/her study, enabling him/her to keep abreast of the latest discovery and enhancing his/her knowledge in the field(s).</p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p> <p>Students are recommended to complete one credit per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfill the research seminar credit requirement.</p>
Reading List and References	Nil

Subject Description Form

Subject Code	LSGI641
Subject Title	Practicum I
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure of the students in teaching and academic related activities.
Intended Learning Outcomes	To develop advanced and effective teaching and communication skills.
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students, irrespective of funding source and mode of study, must complete two training credits before thesis submission. To earn one credit, students will be required to engage in teaching/research supporting activities assigned by the HoD/DoS of his/her delegate for 6 hours/week in any 13-week semester.</p> <p>Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.</p> <p>PhD students who are recipients of stipend (who will be required to undertake departmental training of up to 6 hours per week) or TPS Assistantship (who will be required to undertake teaching assistant activities for 17 hours per week) are allowed to fulfil part of their departmental training requirement or their teaching assistant duties respectively through the completion of these compulsory training credits.</p> <p><i>Note: The current departmental training requirements for all stipend recipients, MPhil or PhD, should remain unchanged.</i></p> <p><u>Teaching Experience</u></p> <p>PhD students who are required to undertake teaching supporting activities in their training credits will be required to complete a training programme organized by the EDC as required by the Department/School.</p> <p>Students who are required to interact directly with students in</p>

	<p>English/Putonghua as a part of their duties in supporting teaching and learning must demonstrate their language competence to fulfil the intended duties to the satisfaction of the host department. All eligible students except those who are native English/Putonghua speakers will also be required to successfully complete a language training programme offered by the ELC/CLC before taking up any teaching supporting activities.</p> <p><i>Note: The above-mentioned training requirements will also apply to MPhil students should they be required to undertake teaching supporting activities.</i></p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to:</p> <ul style="list-style-type: none"> a) ensure that the activities are structured and can be assessed properly; b) submit to the Subject Assessment Panel, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall grade of Pass or Fail.
Reading List and References	Nil

Subject Description Form

Subject Code	LSGI642
Subject Title	Practicum II
Credit Value	1
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	This subject is intended to enhance the exposure of the students in teaching and academic related activities.
Intended Learning Outcomes	To develop advanced and effective teaching and communication skills.
Subject Synopsis / Indicative Syllabus	<p>As part of the programme requirement, all PhD students, irrespective of funding source and mode of study, must complete two training credits before thesis submission. To earn one credit, students will be required to engage in teaching/research supporting activities assigned by the HoD/DoS of his/her delegate for 6 hours/week in any 13-week semester.</p> <p>Students are allowed to complete these two credits any time before thesis submission. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor.</p> <p>PhD students who are recipients of stipend (who will be required to undertake departmental training of up to 6 hours per week) or TPS Assistantship (who will be required to undertake teaching assistant activities for 17 hours per week) are allowed to fulfil part of their departmental training requirement or their teaching assistant duties respectively through the completion of these compulsory training credits.</p> <p><i>Note: The current departmental training requirements for all stipend recipients, MPhil or PhD, should remain unchanged.</i></p> <p><u>Teaching Experience</u></p> <p>PhD students who are required to undertake teaching supporting activities in their training credits will be required to complete a training programme organized by the EDC as required by the Department/School.</p> <p>Students who are required to interact directly with students in</p>

	<p>English/Putonghua as a part of their duties in supporting teaching and learning must demonstrate their language competence to fulfil the intended duties to the satisfaction of the host department. All eligible students except those who are native English/Putonghua speakers will also be required to successfully complete a language training programme offered by the ELC/CLC before taking up any teaching supporting activities.</p> <p><i>Note: The above-mentioned training requirements will also apply to MPhil students should they be required to undertake teaching supporting activities.</i></p>
Assessment Methods in Alignment with Intended Learning Outcomes	<p>Chief Supervisors are required to:</p> <ul style="list-style-type: none"> a) ensure that the activities are structured and can be assessed properly; b) submit to the Subject Assessment Panel, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall grade of Pass or Fail.
Reading List and References	Nil

Subject Description Form

Subject Code	LSGI651
Subject Title	Advanced GNSS Technology and Applications
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	(1) Understand the principle, theory and advanced technology of GNSS precise positioning technology (2) Discuss the scientific and engineering applications of GNSS technology (3) Explore the novel applications of GNSS in the students' research areas
Intended Learning Outcomes	a. understand the principle, theory and advanced technology of the modern satellite-based GNSS positioning and navigation technology; b. hands-on experience of the advanced GNSS applications in environment monitoring and/or other construction areas; c. understand the state-of-the-art of research in GNSS; and d. apply what is taught in this class to their research topics.
Subject Synopsis / Indicative Syllabus	<ul style="list-style-type: none"> • Introduction to GNSS systems <ul style="list-style-type: none"> ▪ Space segment ▪ Control segment ▪ User segment ▪ Development and status of multiple global and regional GNSS systems • Principle of GNSS positioning <ul style="list-style-type: none"> ▪ The coordinate system ▪ The time system ▪ GNSS orbits ▪ GNSS signals • GNSS observation and data structure <ul style="list-style-type: none"> ▪ Carrier phase observation ▪ Pseudorange observation ▪ Observation combinations ▪ Pseudorange smoothing ▪ Carrier phase ambiguity resolution • GNSS error sources and modeling <ul style="list-style-type: none"> ▪ Ionospheric error and its modeling ▪ Tropospheric error and its modeling ▪ Multipath error and its modeling ▪ Clock error and its modeling

	<ul style="list-style-type: none"> ▪ Biases and its modeling • GNSS positioning and augmentation methods <ul style="list-style-type: none"> ▪ Differential GNSS (DGNSS) ▪ Real-time-kinematic GNSS and network RTK ▪ Precise Point Positioning (PPP) ▪ Space-based augmentation system (SBAS) ▪ Ground-based augmentation system (GBAS) • Advanced Applications of GNSS <ul style="list-style-type: none"> ▪ Application in ground traffic ITS ▪ Application in aviation traffic SBAS ▪ Application in geohazard monitoring ▪ Application in structure health monitoring ▪ Application in water vapor remote sensing ▪ Application in space weather monitoring 							
Teaching / Learning Methodology	<p>This subject will be taught and learnt through an instructor-student, theory-practice interactive method. The question-oriented teaching method will be used in the classroom to engage with the PhD students. The students will be asked to conduct two problem-oriented projects in this subject, the outcome of which will be shared to the whole class through oral presentation. This will help the PhD students to enhance their project implementation, project management and project presentation skills.</p>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. In-class test	50%	✓	✓	✓	✓		
	2. Project report	50%	✓	✓	✓	✓		
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture							27 Hrs.
	▪ Lab/Tutorial							12 Hrs.
	Other student study effort:							
	▪ Reading of reference materials							35 Hrs.
	▪ Writing project report							35 Hrs.
	Total student study effort							109 Hrs.
Reading List and References	<p>References:</p> <ul style="list-style-type: none"> • Elliott Kaplan and Christopher J. Hegarty (2017), Understanding GPS/GNSS: Principles and Applications, Third Edition (GNSS Technology and Applications Series), 3rd Edition, Publisher: Artech House. • Ben Levitan and Lawrence Harte (2016), GPS Systems: Technology, Operation, and Applications, Publisher: Discovernet. • Leick Alfred (2015), GPS Satellite Surveying (3rd Edition), Publisher: Wiley (India). 							

Subject Description Form

Subject Code	LSGI652
Subject Title	Remote Sensing in Construction, Urban and Environment
Credit Value	3
Level	6
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	<ul style="list-style-type: none"> • To provide an understanding of advanced remote sensing technologies, such as Ground Penetration Radar (GPR), Radar Interferometry (InSAR), Laser Scanning technology (LiDAR) and hyperspectral remote sensing; • To enable students to deeply understand the state-of-the-art research in these relevant areas; • To enable students to properly identify feasible research topics in these areas.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Master research theory, technology of advanced remote sensing technology; b. Understand the applications in Construction, Urban and Environment; c. Articulate the technologies relating to the integration of disparate sources of acquisition covered in this topic; d. Appreciate the effectiveness and limitation of using these technologies in real-world applications.
Subject Synopsis / Indicative Syllabus	<ul style="list-style-type: none"> • Ground Penetration Radar (GPR) technology and application in Construction, Urban and Environment • LiDAR technology and applications in Construction, Urban and Environment • InSAR technology and applications in Construction, Urban and Environment • Multi-spectral remote sensing and applications in Construction, Urban and Environment • Hyperspectral remote sensing and applications in Construction, Urban and Environment • UAV technology and applications in Construction, Urban and Environment • Future developments/trends in remote sensing technology.
Teaching / Learning Methodology	<p>This subject will be taught and learnt through an instructor-student, theory-practice interactive method. The question-oriented teaching method will be used in the classroom to engage with the PhD students. The students will be asked to conduct two problem-oriented projects in this subject, the</p>

	outcome of which will be shared to the whole class through oral presentation. This will help the PhD students to enhance their project implementation, project management and project presentation skills.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
			a	b	c	d		
	1. In-class test	30%	✓	✓	✓	✓		
	2. Project report	30%	✓	✓	✓	✓		
	3. Assignment	40%	✓	✓	✓	✓		
	Total	100%						
Student Study Effort Expected	Class contact:							
	▪ Lecture							26 Hrs.
	▪ Lab/Tutorial							13 Hrs.
	Other student study effort:							
	▪ Reading of reference materials							39 Hrs.
	▪ Writing project report							39 Hrs.
	Total student study effort							117 Hrs.
Reading List and References	<p>References:</p> <ul style="list-style-type: none"> Hanssen, R.F. (2001), Radar Interferometry Data Interpretation and Error Analysis, 328 pp., Springer, New York. Ferretti A., Monti-Guarnieri A., Prati C. (2007), InSAR Principles: Guidelines for SAR Interferometry Processing and Interpretation, ESA Publications. Noordwijk 234 p Anderson, A., Hardy, E., Roach, J., Witmer, R.. 1976. A land use and land cover classification system for use with remote sensor data. Geological Survey Professional Paper No. 964, US Government Printing Office. Nichol, J.E., Fung, W.Y., Lam K.S., and Wong, M.S., (2009). Urban Heat Island diagnosis using ASTER satellite images and 'in situ' air temperature. Atmospheric Research, 94, 276-284 Strahler, A.H. 1986. On the nature of models in remote sensing, Remote sensing of Environment 20, 121-139. Lillesand, T. and Keifer 2008, Remote Sensing and Image Interpretation, 6th ed. Wiley. Nichol, J.E, 2009. Remote sensing of urban areas. Chapter 32, In Handbook of Remote Sensing, D. Warner, D. Nellis, and G. Foddy (eds), Sage Publications. 							

Part IV

Appendices

Appendix A: Research Committees

PolyU Currently has 3 tiers of administration for matters related to research, namely the Graduate School Board, the Faculty Research Committee and the Departmental Research Committee, to govern and discharge duties in relation to research postgraduate studies.

A1. Graduate School Board (GSB)

The Hong Kong Polytechnic University Graduate School Board (GSB), a Committee of the Senate, is responsible for, amongst other things, reviewing and formulating major RPg education policies, regulations and procedures; monitoring the progress, examination and graduation of RPg students; endorse new initiatives in relation to RPg education; allocating budgets to various funding schemes related to RPg students; and allocating research studentships to Faculties and Departments.

A2. Faculty Research Committee (FRC)

At Faculty level, the FRC plays an important role in reviewing and developing policies and regulations regarding research and research postgraduate studies and makes recommendations accordingly to the Research Committee and Graduate School Board. The FRC provides a forum for discussion and debate on issues of significance relating to research and research postgraduate studies, fostering a culture of active research in the Faculty and encouraging further development in line with the University's research policies.

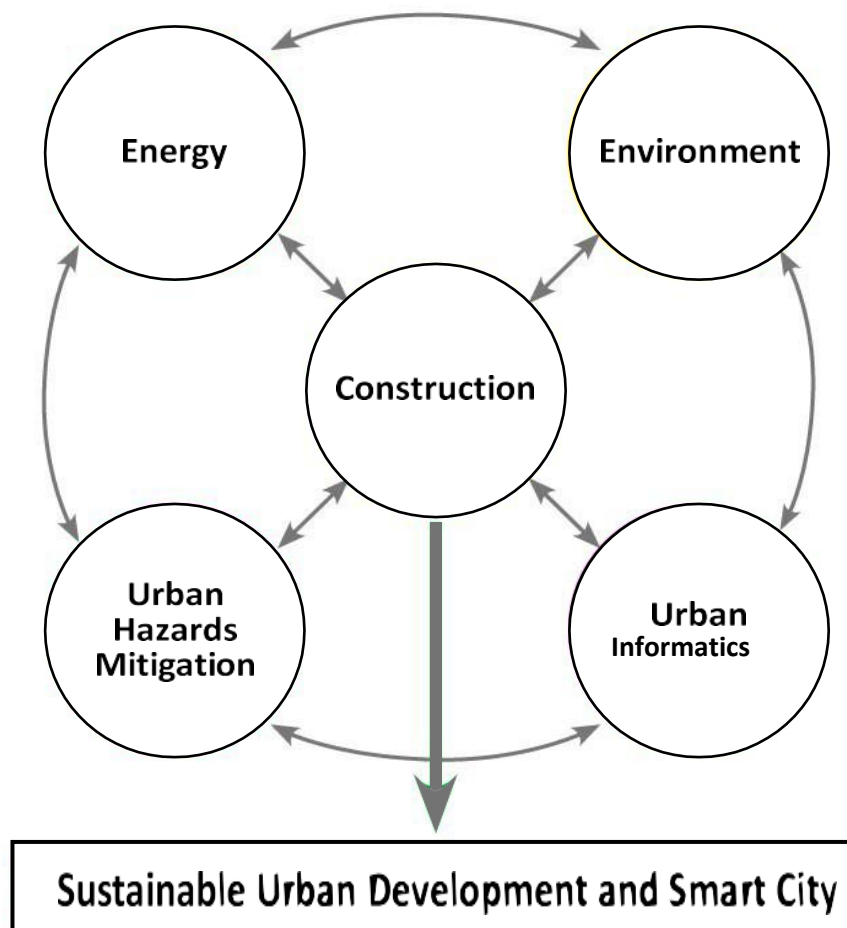
A3. Departmental Research Committee (DRC)

Each department has a research committee. The DRC carries out functions as stipulated in the Administrative Procedures for the research degrees offered by The Hong Kong Polytechnic University for research postgraduate students, including but not limited to considering research postgraduate degree candidates, and monitoring the progress of research projects and of research postgraduate students in the Department.

Appendix B: FCE Research Theme and Departmental Focused Research Areas

B1. Faculty Research Direction

With the largest concentration of research expertise in the construction and environment fields in Hong Kong, FCE is at the forefront of multi-disciplinary and cutting-edge research on Sustainable Urban Development. The interdisciplinary research areas of our four departments focus on various aspects of Sustainable Urban Development, which impinge on and are informed by the fields of Construction, Energy, Environment, Urban Hazards Mitigation and Urban Informatics, as illustrated in the chart below. By consolidating and enhancing our strengths in the interlocking areas, the Faculty is well positioned to become a world leader in creating innovative solutions for Sustainable Urban Development and Smart City.



B2. Focused Research Areas of the Departments

Department of Building Environment and Energy Engineering (BEEE)

<https://www.polyu.edu.hk/beee/>

Building Energy Efficiency

Energy issues in buildings, built environments and districts will be addressed in the context of both demand and supply. Enhancing energy efficiency on the demand side by optimised design and smart control of energy systems, and the effective use of renewables on both supply and demand sides as well as the innovative use of waste for clean energy generation. Enhancing and unlocking the energy flexibility of buildings and district energy system for the carbon-neutral transformation of power systems. Research topics include: robust and optimal design of building HVAC systems; optimal control of building HVAC systems; AI-empowered building energy management, IoT-based distributed optimisation for buildings, energy assessment/diagnosis of buildings with deficient high volume information (Big Data); building and district energy flexibility technologies; photovoltaic integration; hybrid solar-wind power generation; development of advanced renewable energy technologies; hybrid ground-coupled heat pump applications for air-conditioning in hot-climate region; highly dispersed nanocomposite for self-cleaning photovoltaic panels; green building nanomaterial and novel building envelope technology development; novel solar heat-reflective insulation material based on hollow glass micro-balloon cores with hierarchical porous rutile TiO₂ coating; sustainable energy conversion and storage with emphasis on high temperature fuel cells for efficient energy conversion from biofuels or organic waste; planting techniques for enhancing CO₂ absorption for urban rain gardens; technology development and economic feasibility of applying new urban bio-refinery to convert solids wastes derived lignocellulosic biomass into biofuels; low-carbon construction processes.

Building Environment

Research in this area has helped improve indoor and outdoor environments for the comfort, productivity and wellbeing of modern population. Improving indoor built environments involves thermal, indoor air quality (IAQ), visual and acoustic aspects in building and HVAC system design. Technology enabling ventilation and sound insulation has been applied in hostels, public housing estates and a private housing estate. For the best possible indoor environment with minimal energy consumption, research needs to focus on developing innovative technologies beyond improving and integrating existing technologies. These include: provision of desired indoor thermal conditions; novel ventilation strategy for improved IAQ with lowest possible energy use; ventilation-enabling sound insulation technologies; the use of daylight for energy saving and visual comfort etc. A fundamental understanding of human responses to light stimuli, including visual, non-visual, and behavioral responses; and to thermal, both indoors and outdoors, from psychophysical, physiological, and psychological perspectives, is also required. Enhanced wind and thermal comfort in the urban environment can be developed through computational modeling, new design tools and paradigm shift. Multi-disciplinary sound quality assessment and improvement strategies for sustainable city design is another focus. This includes the improvement of total thermal, visual, air and sound quality of the neighborhood environment. Our research is aimed at providing cutting edge knowledges to the stakeholders at large in our society.

Building Safety and Resilience

With intelligent facilities in tall buildings, traditional aspects of building safety such as structural strength and fire resistance must also include newer concerns, such as interference of lightning bolts with electrical and electronic systems. In collaboration with the Shenzhen Meteorological Bureau, a 362 m-high tower was installed with sensors and measuring systems to provide a unique experimental platform for researching the atmospheric environment, such as enabling the interaction of lightning with modern facilities to be investigated in real scale. As the actual lightning current is captured for testing, practical and effective techniques for protection of buildings against lightning can be developed. The mechanisms and process of fire ignition due to lightning current could also be investigated in addition to developing innovative approaches to mitigate the perennial danger of electrical short circuits which are one of the chief causes of fires in homes and buildings. To develop fire safety provisions for supertall buildings, fundamental studies on smoke movement can be conducted. An earlier study of wind effects on fires in a supertall building has demonstrated that heat and smoke emitted from a fire in a supertall building would spread upward, with air entrained at lower levels. Structural response to fire could be simulated at the whole building scale to facilitate an understanding of the progressive collapse mechanisms of tall buildings in large fires that may spread over multiple floors. It is imperative that the limitless potential of state-of-the-art technologies such as sensing, communications and AI is employed to enhance the resilience of urban environments against the fire hazard with a particular emphasis on smarter firefighting.

Department of Building and Real Estate (BRE)

<http://www.bre.polyu.edu.hk/>

Construction Health and Safety

This research area aims to create a safe, healthy, and productive environment (eSHAPE) for construction workers by developing anti-heat stress measures, detecting and mitigating noise hazards, profiling workers' health, developing health and safety measures for workers exposed to silica dust in construction, and reducing the health risks of workers due to hazardous chemicals emission.

A construction uniform with better ultraviolet protection, better breathability and a faster evaporation rate of sweat has been developed for workers who have to toil in hot and humid conditions. Since its launch, the uniform has been adopted by the construction industry. Assessing the level of environmental and physical hazard exposures in the construction industry, and investigating the impacts of different types of chemical and physical hazards on the occupational health of construction workers will better guide occupational health and safety (OHS) policy and measures, applying controls when and where appropriate, as well as informing construction workers about adverse health behaviors.

Digital Construction

This research area aims to develop digital solutions to ensure successful project delivery of construction projects with minimum time and cost, while maintaining high quality and reducing accidents. The emergence of digital technologies has the potential to greatly improve the project delivery processes. For example, Building Information Modelling (BIM) enables 3D representations of building components and processes. The Internet of Things (IoT) facilitates information exchange between machines without the need for human intervention. Industrial robotics and 3D printing technologies can automate construction operations.

Sustainable Urban Systems

This research area aims to achieve sustainable urban development by conducting scientific studies at a whole range of levels, from industrial to city to districts etc. A 3D spatial analysis of different plot ratio/building height (PR/BH) scenarios on urban skyline, visual effect, shadow and insolation, wind ventilation, and air temperature has enabled decision makers to formulate scientific and rational decisions for sustainable urban development. At the building level, an energy assessment system for new buildings and a unified decision support system for green retrofit in existing buildings have been developed. At the project level, a RFID-Enabled BIM Platform for Prefabricated Housing Production in Hong Kong has facilitated effective management of the supply chain in prefabricated housing production. This platform has been widely regarded as a very useful tool for information management by stakeholders in the supply chain, including the Housing Authority (the client), Gammon Construction (the contractor), and Wing Hong Shun (the façade supplier). Research in this area is primed to inform the construction of smart cities, which is the foreseeable trend of the future.

Department of Civil and Environmental Engineering (CEE)

<https://www.polyu.edu.hk/cee/>

Smart and Resilient Transportation

Traffic congestion, air pollution, and inclement weather are ongoing problems in many densely populated cities in Asia such as Hong Kong. Their impacts on economic productivity, network resilience, the environment, human health and safety are undeniable. However, due to the topography and the constraints of urban development in Hong Kong, further expansion of the existing road transport network is open to question. **Smart and resilient transportation** addresses the multi-modal transportation needs of society in a sustainable manner. The development of Intelligent Transportation Systems (ITS) is one of the essential steps towards **smart and resilient transportation** in Hong Kong's congested transportation network under uncertainties.

This research area includes developing various advanced solution algorithms for data fusion of different real-time traffic sensor data, robust solution algorithms for on-line estimation of journey times, traffic speeds and traffic states in congested networks with uncertainties, reliability-based path finding algorithm for ITS applications, and computational methods for enhancing network resiliency. The results have contributed to the advancement of the relevant research fields, and at the same time have made significant impacts in Asian cities. Some of the robust solution algorithms developed have already been implemented in the ITS projects in Hong Kong and Bangkok. It is hoped that further research would improve the efficiency and resiliency of traffic systems together with the planning, design and operation of urban infrastructure.

Smart Urban Water and Coastal Resilience

Hong Kong, a typical coastal city located in the subtropical region, faces frequent climatic extremes, including water resource scarcity and coastal compound disasters. Over 70% of its freshwater resources are sourced from Guangdong Province (Mainland China) at a significant investment cost. However, the urban water supply systems experience a water loss rate of 15%, costing over HK\$ 2 billion annually in water and energy resources. This situation is becoming increasingly critical due to the impacts of climate change and urbanization. Moreover, extreme weather events such as *tropical cyclones, typhoons, rainstorms, droughts, and heat waves* have become more frequent and intense in coastal areas/regions globally, including Hong Kong. For instance, several super-typhoons in the past five years—such as "*Hato*" in 2017, "*Mangkhut*" in 2018, and "*Saola*" & "*Haikui*" in 2023—have caused severe damage to buildings and public utilities, and even resulted in casualties in Hong Kong and the surrounding Greater Bay Area (GBA) of China.

In this context, our research focuses on exploring **Smart and Sustainable Urban Water Systems** and developing **Climate-resilient Coastal Cities**. The findings in Smart and Sustainable Urban Water Systems have led to innovative solutions for managing water resources (for both quality and quantity), addressing the uncertainties and variabilities of water supply and demand under climate change in the GBA of China. This research supports the "Water Intelligence Network (WIN)" strategy launched by the Hong Kong Government. Furthermore, we have developed an intelligent analysis framework and HF-radar monitoring network for coastal compound disasters and hydro-environment, which enhances the climate-resilience of coastal urban development and contributes to the future Smart City

Development of Hong Kong. Additionally, we have also explored the coastal-ocean renewables (wind-wave-solar hybrid energy hub) in the Hong Kong and GBA waters with implementing advanced hydrodynamic methods and sophisticated experimental design technologies. These studies have been supported by government departments in Hong Kong and the GBA of China, as well as industrial partners, through large-scale collaborative research projects and knowledge transfer schemes.

Sustainable Materials and Structures

The sustainability of urban infrastructure is an issue of great concern to all major cities and particularly high-density cities such as Hong Kong. Research in the area of **Sustainable Materials and Structures** aims to enhance the sustainability of urban infrastructure by minimizing the use of materials and resources (and hence the carbon footprint) per year of service for a given infrastructure project. Researchers from structures, pavements and concrete technology in CEE work synergistically with researchers outside CEE (e.g., researchers in material science, chemistry and computer science) to enable major advances in the area.

The infrastructural use of high-strength materials such as fiber-reinforced polymer (FRP) composites, high-strength steel and ultra-high performance concrete for a new generation of infrastructure has enabled huge savings in construction materials. Research on long-life infrastructure by means of high-durability materials and/or advanced monitoring and maintenance techniques is another related aspect. In ensuring the long-service life of infrastructure, smart technologies (e.g., robotic, machine learning) are needed to equip our infrastructure with the ability to sense, respond to and recover from severe environments (e.g., marine environments), extreme loadings (e.g., typhoons and earthquakes), and climate change effects.

Despite the use of high-performance materials and advanced technologies to extend the lifespan of infrastructure, every structure or facility will eventually reach the end of its life. Therefore, developing end-of-life strategies for demolition waste is crucial for the sustainability of infrastructure. This research area also includes exploring methods to recycle demolition and other wastes into new structures and useful products.

Sustainable Urban Environment

Deteriorating air quality, increasing amounts of wastewater and solid waste, and rapidly growing energy consumption have been major environmental problems in densely populated cities such as Hong Kong. These issues pose threats to human health and the ecosystem, and impede the potential for urban development. Owing to their extreme complexity and rising mitigation/treatment costs, the solutions to these issues remain elusive. The research area on **Sustainable Urban Environment** explores cost-effective pathways of development in theory and in practice for combating these environmental problems in urban cities.

The research area includes studies on the formation mechanism, health effect, and abatement strategy of atmospheric pollution, the chemical and biological treatment of wastewater, and the conversion of different types of waste to construction materials (e.g. Eco-block) and useful chemicals. The research findings have contributed to the formulation and evaluation of pollution control policies both locally and internationally (e.g., assessment of vehicular emission control and cross-border impact on air quality in Hong Kong and of air pollution mitigation measures in mainland China); the Eco-block technology has been transferred to the private sector and it has been widely used in Hong Kong.

Urban Geohazards and Mitigation

There are over 60,000 registered man-made slopes in Hong Kong, and numerous slopes in the natural terrain across the city. Many of these slopes are close to the developed areas, and therefore assessing and enhancing slope stability is key to our sustainable development. Our research efforts involve hazard analyses of man-made slopes and debris flows, and the associated mitigative measures. Through concerted efforts of the government authorities, academia and industry, the number of fatal man-made slope failures has dropped rapidly in recent years. Therefore, the research focus has been gradually shifted to the study and monitoring of slopes in natural terrains.

Our research efforts on geohazards and mitigation relating to landslides can be classified into two main areas: (1) theoretical, experimental and numerical analyses on landslides, rockfalls and debris flows hazards, and various innovative stabilization methods; (2) field monitoring technologies, including GIS, GPS, IOT, fibre optic sensors and cloud computing, have been developed and employed for slope monitoring. The research endeavours have led to the development of design and analysis software, "Slope 2000" and "Slope3D", which have been used in many major projects in Hong Kong and around the world. A large-scale debris flow flume was built to facilitate the investigation on the effectiveness of various designs of debris flow barriers.

Smart Positioning and Mobility

Navigation technologies are the core technologies to support a mobile internet, Location Based Services (LBS), and the Internet of things (IoT). Satellite based navigation systems (i.e. GPS, GLONASS, Beidou, and Galileo), as the backbone of navigation technologies, have become the fundamental infrastructure for national security and economic growth. Smart mobility is crucial for a smart city by reducing traffic congestion and pollutions, improving transfer speed and safety, and reducing transfer cost. LSGI has conducted research on navigation technologies and smart mobility for more than 30 years. A Navigation Laboratory has been established since 1999. In recent years, research on key issues (i.e. GNSS signal shadowing, GNSS multipath, and seamless positioning) for urban positioning and navigation technologies has supported economic development in Hong Kong. As a satellite navigation system developed in China, Beidou has been integrated with other navigation systems to improve navigation performance in urban areas and to promote the applications of the Beidou system internationally. A public transport enquiry system has also been developed and adopted by the Transport Department for public use since 2010.

Spatial Big Data Modelling and Analytics

Spatial big data modelling and analytics is based on a) the emerging research topic of big data, especially spatial big data in the geographic information science (GIS) community, and b) the related research accumulation of LSGI in the areas of spatial, temporal and dynamic data modelling, and spatial analyses in GIS. The proposed focus will contribute to the research and development of urban informatics in smart city with respect to data modelling and analysis. Strategies for this research focus include (i) identifying the need for spatial big data modelling and analytics in the context of smart city development; (ii) forming an inter-disciplinary research team at PolyU on spatial big data analytics; (iii) applying for large research grants related to this research focus; (iv) developing solutions for spatial big data modelling for heterogeneous, multi- resolution sources of spatial data; (v) creating spatial data models for an integrated indoor and outdoor environment; (vi) proposing analytical methods for dynamic urban data; (vii) analyzing and predicting urban mobility and dynamic behavior based on spatial bigdata.

Urban Sensing and Measurement

Research in this area has included urban heat island research, urban atmosphere monitoring, urban hazard monitoring, urban utility and infrastructure monitoring and management, urban 3D mapping, and 3D modelling for urban applications. The research prospect for the future will include (i) urban remote sensing for environment monitoring and modelling; (ii) urban remote sensing for hazard/deformation monitoring of urban infrastructures; (ii) urban underground utility monitoring and management; (iii) advanced photogrammetric hardware and software systems for near real-time 3D measurement of urban scenes; (iv) more automated 3D/4D city modelling with a high level of details from multiple-source remote sensing datasets; (v) developing a spatial data infrastructure for smart city development in Hong Kong.

Appendix C: Faculty and University Central Research Facilities

C1. Faculty Research Facilities

The Faculty and its Departments provide tremendous funding for research infrastructure development and enhancement. Please visit the websites of our four departments for details of the state-of-the-art equipment and facilities of our 60 research laboratories.

Department of Building Environment and Energy Engineering (BEEE)

BEEE	<p>Acoustics Laboratory</p> <p>This lab is equipped with all essential and advanced equipment for the study and measurement of sound and vibration (both indoor and outdoor). There is an acoustics testing chamber that conforms to ISO/BS/ASTM standards for testing sound transmission loss, sound absorption and machine sound power.</p> <p>Advanced Air-conditioning and Energy Storage Technology Laboratory</p> <p>This laboratory consists of two experimental test rigs for carrying out both scientific and applied research on the advanced liquid desiccant dehumidification system and the novel three-phase absorption thermal energy storage system. The two test rigs are equipped with advanced data acquisition system, which can measure and collect a large number of physical and chemical properties for characterizing and modeling of the two types of system. The test rigs can also facilitate the development and test of the control methods/strategies.</p> <p>Advanced Cooling System Laboratory</p> <p>The laboratory aims to provide a platform for students to conduct scientific research, experiments and measurement on advanced cooling technologies. The facilities can be used to evaluate surface energy and thermal behaviour of advanced building envelopes and to investigate advanced solar PV glazing technologies.</p> <p>Advanced Thermal and Environmental Engineering Laboratory</p> <p>The laboratory is equipped with ductless fume hood and clean booth to conduct experiments that involve the process sensitive to chemical and requiring extreme cleanliness, for fabricating and characterizing devices and materials related to indoor environmental quality. A set of aerosol generation and characterization equipment, a microscope imaging system as well as a wind tunnel with high-speed camera allow researchers to analyse the relevant structure and fluid flow.</p>
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BEEE	<p>Building Energy and Automation Research Laboratory</p> <p>The Building Energy and Automation Research Laboratory facilitates research on building energy efficiency and the use of modern IT/computing technologies to improve building energy performance. It has developed a building system online performance simulation platform and a building automation control and diagnosis strategy online test platform, in addition to various tools for building performance diagnosis and optimisation. Developing and managing a centralised energy monitoring and assessment platform to monitor and control the energy performance of PolyU's campus buildings, the lab also helps many local developers and building owners to develop optimal and energy-efficient control strategies and optimised control instrumentation solutions to improve the energy efficiency of their buildings.</p> <p>Built Environment Simulation Laboratory</p> <p>The Built Environment Simulation Laboratory is designed for teaching and research purposes. The Laboratory is equipped with the state-of-the-art facilities for cross-platform game engine development of building simulation and implementation in immersive virtual reality (IVR), augmented reality (AR) as well as mixed reality (MR). High dynamic range (HDR) panoramic cameras and LiDAR scanners are provided for generating 3D visualization and other VR applications in environmental design. In addition, high-resolution VR retina displays and other multi-media devices are available for experiments and CGI projects.</p> <p>Carbon Neutral Building Laboratory</p> <p>The laboratory aims to provide a research platform for students to conduct experiments and measurement on thermally-regulated constructed surfaces. The facilities can be used to evaluate the optical properties of glazing technologies and constructed surfaces.</p> <p>Colour and Illumination Laboratory</p> <p>Facilities in the lab cover a wide range of testing, measurement, and calibration equipment and protocols for various imaging systems, including cameras, displays, virtual reality, augmented reality, and mixed reality systems. In addition, various tunable lighting equipment can be used to carry out experiments to better understand how the human beings respond to light and color stimuli under different viewing conditions. These can be used to develop metrics for different imaging systems and also to further our understanding about the human visual system.</p> <p>Design and Development Centres</p> <p>Computer-Aided Design (CAD) and drafting form an important part of the Department's teaching programmes. The facilities in our Design and Development Centres include the latest Pentium computers and various plotting and printing facilities linked by a LAN. Peripherals include scanners, digitisers, large plotters and various printing facilities. It also provides computing facilities for our BEEE students.</p>
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BEEE	<p>Electrical Services Laboratory</p> <p>Facilities in the electrical services lab are suitable for testing and commissioning electrical installations, testing electrical equipment, conducting power quality analyses (harmonics, transients, etc.) and electro-magnetic field measurements and lightning detecting and monitoring systems, among others.</p> <p>Fire Engineering Laboratory</p> <p>There are two fire chambers that can conduct large-scale burning tests up to 1 MW and are well-equipped with instruments to measure temperature, smoke motion, fire heat release rate, material flammability and fire emission toxicity. Various fire protection systems are installed to evaluate fire suppression performances. Wind tunnels are available for evaluating the thermal sensitivities of sprinkler heads and fire detectors. The newly developed Digital Twin system can monitor the real-time fire scene and forecast future fire development.</p> <p>HVACR Laboratory</p> <p>Air conditioning systems provide comfortable interior thermal environments for building occupants. The process involves the removal of heat and humidity by different types of air handling equipment. Fans are used to distribute the conditioned air to various interior zones of a building through air ducts. In the HVAC lab, students can study the operating characteristics of fans and the air-flow disturbance along an air duct using the Fan Test Rig and the Air Duct and Damper Test Rig. Other experimental equipment includes a Refrigeration Laboratory Unit, a Bench Top Cooling Tower and an Air Conditioning Laboratory Unit.</p> <p>Indoor Air Quality (Bioaerosol) Laboratory</p> <p>The Laboratory at Biological Safety Level 2 (BSL-2) is equipped with a Class II biological safety cabinet, as stated in the “Guidelines on Biosafety in the Clinical Laboratory” issued by the Department of Health (2005). The lab is also equipped with a wide range of bioaerosol sampling facilities for laboratory and field studies, including single stage impactors, Anderson samplers, biotest RCS plus, an incubator and an autoclave.</p> <p>Indoor Environmental Quality Laboratory</p> <p>Most of the test rigs in this lab are portable, comprising various gas analysers, temperature, humidity and air flow sensors for measurements in occupied spaces, on air-side systems, etc. The manikin is an important piece of equipment for investigating thermal comfort and indoor air quality. Integrated analysis of the data in different areas such as thermal comfort, indoor air quality and subjective human responses can be carried out.</p>
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BEEE	<p>Intelligent Building Laboratory</p> <p>The Intelligent Building (IB) Laboratory facilities include a comprehensive IB system, a full set of building automation systems, test rigs for IoT-enabled building automation, VR and AI-enabled building energy facility management, grid-interactive building technology and energy-flexible building technologies as well as a variety of measurement instruments for building energy monitoring. The IB lab provides test facilities for teaching and learning as well as for R&D on intelligent building technologies, the development of advanced building system control, energy management, diagnosis strategies and communication software.</p> <p>Lighting Laboratory</p> <p>The Lighting Lab's goniophotometer, integrating sphere and spectroradiometer help to characterise various photometric (e.g., luminous flux, luminous intensity distribution) and colourimetric (e.g., spectral power distribution, correlated colour temperature, chromaticity coordinates, CIE Colour Rendering Index, IES TM-30-15, etc.) quantities for light sources and luminaires. The High Dynamic Range Imaging System allows us to perform luminance and glare analyses for exterior and interior luminous environmental assessments. In addition, the 14-channel spectrally tunable LED lighting system, spectroradiometer, spectrophotometer and standard viewing booth allow us to simulate different lighting conditions and to perform colour characterisation using different materials and surface colours.</p> <p>Lightning Physics and Protection Laboratory</p> <p>This lab facilitates research on the formation, detection of and protection from lightning. It includes various instruments specially designed for lightning research, such as slow and fast antennae and a magnetic loop antenna for measuring lightning-caused electric fields, a lightning location system, high-speed camera, broadband interferometer system and lightning current measuring system. It also includes various instruments for general use, such as high-speed oscilloscopes and data recorders. Due to the nature of lightning, these instruments are usually installed in fields outside the lab for experiments during the summer. The lab also has various sets of software for modelling lightning processes.</p> <p>Low-carbon Building Technology Laboratory</p> <p>The Low-carbon Building Technology Laboratory consists of a stainless-steel cladded environmental chamber the size of a typical office, and a stand-alone air-conditioning system. The chamber also has following provisions:</p> <ul style="list-style-type: none"> a) two types of air distribution methods; b) Radiant ceiling panels c) Thermal manikins, heat and moisture sources <p>The lab accommodates a variety of experimental studies.</p>
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BEEE	<p>Multi-Function Chamber Laboratory</p> <p>The Multi-Function Chamber Laboratory is equipped with a main heating and cooling plant comprising a chiller, a boiler, hot and chilled water pumps, an air handling plant and a main supervisory control and data acquisition centre. The temperature, relative humidity and air-flow within the chamber can be precisely controlled over a wide range of set-point conditions for various precision measurements.</p> <p>Piped Services Laboratory</p> <p>This lab provides facilities for testing and commissioning building water supply and drainage systems. Bench-scale test rigs are set up to assess the performance and efficiency of various system components.</p> <p>Renewable Energy Laboratory</p> <p>Established in August 2014, the lab enables fundamental and applied research on solar energy materials and green building materials in collaboration with industry and leading academic institutions, providing advanced and innovative technological solutions for the generation of renewable energy and a sustainable built environment.</p> <p>RISE Academic Studio</p> <p>RISE Academic Studio is a functional space well equipped with video and audio facilities to support face-to-face and online academic exchanges and functions of different natures and at different levels.</p> <p>Solar Simulation Laboratory</p> <p>The lab provides facilities for testing solar energy devices for thermal and photovoltaic applications. The solar simulator is mainly used for the research and development of solar energy applications in buildings, product tests of solar energy equipment and heat loss measurements of various building façade elements and devices.</p>
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Department of Building and Real Estate (BRE)

BRE	<p>Smart Construction Laboratory</p> <p>The Smart Construction Laboratory has been providing industrial services covering and extending the use of Building Information Modelling (BIM), process simulation solutions and professional training to the construction industry.</p> <p>Ng Wing Hong Laboratory for Sustainable City</p> <p>This high-level laboratory provides an information technology infrastructure for examining the sustainable development of Hong Kong at the building and city level. The laboratory facilitates the archiving, processing and retrieval of databases and information in multi-media formats.</p> <p>Building Technology Laboratory</p> <p>The laboratory provides demonstration classes and hands-on building technology experiments on structural mechanics, concrete testing and non-destructive techniques for building diagnostics and inspection. The Laboratory supports research on 3D concrete printing, construction robotics and robotics exoskeleton.</p> <p>IT Teaching Room</p> <p>Students can use any of the PC stations in the IT Teaching Room on a first-come, first-served basis during non-teaching sessions.</p> <p>Smart Infrastructure Management Systems Laboratory (SIMS)</p> <p>The mission of SIMS is to foster world class excellence in research, training and technology transfer activities in the important area of sustainable civil infrastructure. The emphasis is on the research and development of effective design, rehabilitation, and management strategies.</p>
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Department of Civil and Environmental Engineering (CEE)

CEE	<p>The Department manages 31 laboratories, 1 mechanical workshop and 1 computer room to provide a controlled environment to support teaching, research and services to the community. The Department has the following laboratories and workshop under different units.</p> <p>Construction and Transportation Unit</p> <ul style="list-style-type: none">- Road Research Laboratory- Transport and Highway Engineering Laboratory <p>Environmental Engineering Unit</p> <ul style="list-style-type: none">- Advanced Environmental Microbiology Laboratory- Air Pollution Laboratory- Atmospheric Research Laboratory- Bioenergy Research Laboratory- Carbon Analysis and Filter Handling Clean Room- Cell Culture Laboratory- Environmental Chamber- Environmental Separation Process Laboratory- Indoor Air Aerosol Science Laboratory- Laboratory for Advanced Environmental Studies- Noise and Safety Laboratory/ Semi-anechoic Chamber- Water and Waste Teaching Laboratory- Water and Waste Research Laboratory- Water Analysis Laboratory <p>Geotechnical Engineering Unit</p> <ul style="list-style-type: none">- Geology Laboratory- Rock Mechanics Laboratory- Smart Geotechnology Laboratory- Soil Mechanics Laboratory <p>Hydraulic Engineering Unit</p> <ul style="list-style-type: none">- Hydraulics Laboratory <p>Structural Engineering Unit</p> <ul style="list-style-type: none">- Concrete Materials Laboratory- Concrete Technology Laboratory- Engineering Materials Micro-Mechanics Laboratory- Functional Construction Materials Laboratory- Light Structures Laboratory- Materials and Structures Durability Laboratory- Structural Engineering Research Laboratory- Structural Dynamics Laboratory- Smart Structures Laboratory- Sample Preparation Room <p>Workshop</p> <ul style="list-style-type: none">- Mechanical Workshop <p>Others</p> <p>Computer Room</p>
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Department of Land Surveying and Geo-Informatics (LSGI)

LSGI	<p>Laboratory for Smart City and Spatial Data Analytics</p> <p>The Laboratory aims to bring academics, researchers, professionals and students together to generate innovative ideas, advanced technologies and practical solutions for smart cities. It provides one-stop facilities for research and development, including a spatial big data analytics server, spatial 3D data server, video- conferencing, TV wall, virtual reality (VR) and augmented reality (AR) visualisation systems.</p> <p>Survey Store and Instrumentation Laboratory</p> <p>The lab loans equipment and maintains and produces special accessories to support teaching and research activities in the Department.</p> <p>Digital Cartography Laboratory</p> <p>This lab is equipped with 40 sets of computers and digitising tablets. Installed with various GIS, CAD and database software, the laboratory is used mostly for teaching and students' practical work in GIS, cartography and digital mapping.</p> <p>Underground Utility Survey Laboratory</p> <p>This lab provides an indoor and controllable environment in which the orientations, depths, sizes, material types and coordinates of various utility networks are carefully designed and recorded. All of these attributes are geo-referenced and integrated into a geographic information system. Surveys are conducted by a range of utility survey and near-surface geophysical equipment.</p> <p>Geomatics Computing Laboratory</p> <p>This lab provides a general computing facility for all teaching staff and students in the Department to achieve a number of teaching and learning objectives.</p> <p>Photogrammetry and Remote Sensing Laboratory</p> <p>This lab houses a 30 seat computing space and specialist equipment space. The computing space is equipped with 15 PCs with access to ERDAS Imagine, ContextCapture, Agisoft PhotoScan, PhotoModeler, and Leica Cyclone v6.0 software. The specialist equipment space houses an Intergraph ImageStation DPW, an Intergraph PhotoScan TD, a dual screen Leica LPS DPW, a Peiss P3 analytical stereo plotter, and provides a workspace for laser scanning projects. The lab is also equipped with instruments and sensors for advanced research and development in photogrammetry and robotic vision, and a demonstration platform for planetary mapping and remote sensing research.</p>
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LSGI	<p>Remoted Sensing Laboratory</p> <p>This lab aims to implement high-impact and high-quality research through cross disciplinary collaborations among faculties/schools and other UGC institutions, provide new insight into a wider range of research areas, and maximize their impact and benefit to society. Apart from continuing to focus on the environmental applications of the state-of-the-art remote sensing systems, as well as the development of techniques to enhance the usefulness of these systems, the lab also expands its research endeavours to the application of remote sensing technologies in teaching and learning.</p> <p>Hydrographic Survey Laboratory</p> <p>The hydro lab has evolved into a modern laboratory to meet various university teaching, research and consulting requirements. It has a suite of advanced instruments and software for teaching, research and consulting services.</p> <p>Navigation Laboratory</p> <p>Jointly set up by the Department and Nanjing University of Aeronautics and Astronautics (NUAA), the laboratory supports four main areas of research: integrated navigation systems; GNSS and positioning; and intelligent transportation systems (ITS) and location based services (LBS).</p> <p>Laboratory for Deformation and Geohazards Studies</p> <p>This lab facilitates research in developing new technologies such as GNSS (Global Navigation Satellite Systems), InSAR (Interferometric Synthetic Aperture Radar) and in-situ sensor-based technologies, and in studying geohazards such as landslides, earthquakes, land subsidence and structural health. The laboratory is equipped with advanced hardware and software.</p> <p>JC STEM Lab of Earth Observations</p> <p>The JC STEM Lab of Earth Observations is an effort of the PolyU, the Hong Kong Jockey Club Charities Trust, and the Hong Kong SAR government to support the “Global STEM Professorship Scheme”. The laboratory will focus on the development of original and innovative EO methodologies and technologies and their applications for studies of the causes, effects, and responses to environmental and societal challenges in cities and urban areas, with the goal of becoming a global research hub in EO.</p>
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C2. University Research Facilities

University Research Facility in 3D Printing (U3DP)

The University Research Facility in 3D Printing (U3DP) aims at providing all-round support for PolyU staff, researchers and students in applying various types of 3D printing technologies to excel their research works and academic study. It serves as a technology and knowledge hub of 3D printing technologies to unleash students' imagination for innovation and enhance their interest in design and make. It also opens up new initiative for research and industrial collaboration.

University Research Facility in Big Data Analytics (UBDA)

The University Research Facility in Big Data Analytics (UBDA) aims to provide an infrastructure with software tools and offer an open platform for cross-disciplinary collaboration among researchers and external partners to develop, support, service and sustain research into big data analytics. The UBDA infrastructure has 5 layers, including the Storage Layer, Network Layer, Computing Cluster Layer, Application Layer and Service Layer.

University Research Facility in Behavioral and Systems Neuroscience (UBSN)

The University Research Facility in Behavioral and Systems Neuroscience (UBSN) is a state-of-the-art think tank and interdisciplinary technological platform supporting the research endeavors of PolyU's principal investigators and researchers as well as those from other higher education institutions in Hong Kong. It serves as a key training hub for all who are pursuing scientific enquiry in neuroscience and related disciplines.

University Research Facility in Chemical and Environmental Analysis (UCEA)

The University Research Facility in Chemical and Environmental Analysis (UCEA) provides an interdisciplinary platform for chemical and environmental research with a total of 18 major equipment located in 9 different laboratories. The collection of cutting-edge equipment, ranging from high resolution mass spectrometer, solid state Nuclear Magnetic Resonance (NMR) spectrometer to third generation DNA sequencer, encourages the research atmosphere and nurture collaboration from experts in different background.

University Research Facility in Life Sciences (ULS)

The University Research Facility in Life Sciences (ULS) provides access to advanced instruments for conducting research in the life sciences, facilitating multidisciplinary research and innovations, maintaining core facilities, and training research staff and students.

University Research Facility in Materials Characterization and Device Fabrication (UMF)

The University Research Facility in Materials Characterization and Device Fabrication (UMF) serves as a catalyst for multidisciplinary education and innovations, coordinating activities, maintaining core and shared facilities, training students, and fostering collegial exchanges of expertise.

Appendix D: Contact of FRC and DRCs

Faculty of Construction and Environment

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Faculty of Construction and Environment

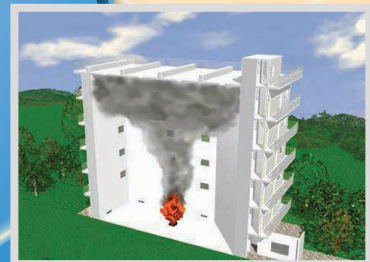
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