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Academic Program: Doctor of Philosophy in Biomedical Engineering
 Academic Year: 2020
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Study Scheme

Postgraduate Student Handbook 2020-21 (EMB-I)

FACULTY OF ENGINEERING

Biomedical Engineering

Study Scheme

M.Phil. – Ph.D. Programme in Biomedical Engineering (Full-time and Part-time)

A. M.Phil. Student

1. Coursework Requirement

(a) Lecture courses:

Each M.Phil. student is required to complete a minimum of 15 units of 5xxx graduate courses offered by the Division, or by other Divisions subject to the approval of the supervisor and Division Head. At least one faculty core courses must be taken. To satisfy the Faculty core course requirement, students must achieve at least a grade B in the course. Otherwise, the course will only be counted as an elective.

<u>Code</u>	<u>Course Title</u>	<u>Unit</u>
BMEG5100	Advanced Medical Robotics	3
BMEG5110	Advanced Medical Devices and Sensor Networks	3
BMEG5120	MEMS and Nanotechnology for Biomedical Engineering	3
BMEG5130	Biomedical Imaging Processing	3
BMEG5140	Rehabilitation Engineering	3
BMEG5210	Medical Visualization	3
BMEG5310	Biomedical Engineering Seminar I	1
BMEG5320	Biomedical Engineering Seminar II	1
BMEG5330	Biomedical Engineering Seminar III	1

BMEG5340	Biomedical Engineering Seminar IV	1
BMEG5610	Research Methods in Biomedical Engineering	3
CSCI5330	Advanced Algorithms for Bioinformatics	3
ELEG5120	Selected Topics in Biomedical Engineering	3
ELEG5130	Prosthetics and Artificial Organs	3
ELEG5140	Biomedical Information Engineering	3
ENGG5404	Micromachinery and Microelectromechanical Systems	3
MAEG5080	Smart Materials and Structures	3

Faculty Core Courses

ENGG5101	Advanced Computer Architecture	3
ENGG5103	Techniques for Data Mining	3
ENGG5104	Image Processing and Computer Vision	3
ENGG5105	Computer and Network Security	3
ENGG5106	Information Retrieval and Search Engines	3
ENGG5108	Big Data Analytics	3
ENGG5189	Advanced Artificial Intelligence	3
ENGG5202	Pattern Recognition	3
ENGG5281	Advanced Microwave Engineering	3
ENGG5282	Nanoelectronics	3
ENGG5291	Fiber Optics: Principles and Technologies	3
ENGG5301	Information Theory	3
ENGG5302	Random Processes	3
ENGG5303	Advanced Wireless Communications	3
ENGG5383	Applied Cryptography	3
ENGG5392	Lightwave System Technologies	3
ENGG5402	Advanced Robotics	3
ENGG5403	Linear System Theory and Design	3
ENGG5404	Micromachining and Microelectromechanical Systems	3
ENGG5405	Theory of Engineering Design	3
ENGG5501	Foundations of Optimization	3
ENGG5601/	Principles of Biomechanics and Biomaterials	3
BMEG5150		
ENGG5781	Matrix Analysis and Computations	3

Student shall consult and obtain permission from the supervisor on course selection (the supervisor's signature on the course selection form is needed.)

Note:

- (1) Each Lecture course normally carries three (3) units.
- (2) Each student will receive grades (A to F) every term for lecture courses. The pass grade for all courses is D or above.

(b) Thesis research / monitoring courses:

Each M.Phil. student must register for the relevant Thesis Research Course in every term throughout his/her study period.

- Full-time M.Phil. students: BMEG8006
- Part-time and Continuing M.Phil. students: BMEG8003

Note:

- (1) BMEG8006 carries 6 units and BMEG8003 carries 3 units. Each unit should be regarded as equivalent to approximately 3 hours of study/research per week by the student.
- (2) Each student will receive grades (A to F) every term for Thesis Research courses. The pass grade for all courses is D or above.

2. Other Requirements

- (a) Students must fulfill the Term Assessment Requirement of the Graduate School. For details, please refer to Clause 13.0 "Unsatisfactory Performance and Discontinuation of Studies" of the General Regulations Governing Postgraduate Studies which can be accessed from the Graduate School Homepage: <http://www.gs.cuhk.edu.hk>.
- (b) Students are required to submit a research thesis, and pass an oral examination for graduation.
- (c) Each student must present a graduate seminar.
- (d) Complete an Improving Postgraduate Learning (IPL) module on "Observing Intellectual Property and Copyright Law during Research". This is an online module and relevant information can be accessed from the website: <http://www.cuhk.edu.hk/clear/prodev/ipl.html>.
- (e) All students are required to attend IPL modules on "General Safety" and pass the corresponding examinations within the first 18 months of their normative study period.
- (f) Complete an Improving Postgraduate Learning (IPL) module on "Introduction to Research & Thesis Writing For Engineering, Medicine & Science" in the first year of their study.
- (g) Students admitted in 2017-18 and thereafter are required to complete an online Research Ethics Training (RET) module on "Publication Ethics" offered by the Office of Research and Knowledge Transfer Services (ORKTS) and obtain a valid Publication Ethics Certificate for graduation. Relevant information can be accessed from the RET website at <https://www.research-ethics.cuhk.edu.hk/web/>.

Note:

- (1) Students from the M.Phil. programme may apply for transfer to the Ph.D. Programme as a Ph.D. student (pre-candidacy) with a recommendation letter from the supervisor. The Division will consider the application and decide if approval is granted.
- (2) The length of study will follow the regulation stipulated by the Graduate School.

B. Ph.D. Student (Pre-candidacy)

The "candidacy requirement" composes of three major parts, namely, coursework requirement, candidacy examination, and thesis proposal (and oral defence). Students

must complete and fulfill all three parts within the “maximum period for fulfilling candidacy requirements”. Details of the requirement are listed below:

1. *Coursework Requirement*

(a) Lecture courses:

(Applicable to students admitted in 2016-17 and before)

Each Ph.D. student is required to complete a minimum of 15 units of 5xxx graduate courses offered by the Division, or by other Divisions subject to the approval of the supervisor and Division Head. At least one faculty core courses must be taken. To satisfy the Faculty core course requirement, students must achieve at least a grade B in the course. Otherwise, the course will only be counted as an elective.

(Applicable to students admitted in 2017-18 and thereafter)¹

Each Ph.D. student is required to complete a minimum of 21 units of courses offered by the Division, or by other Departments/Divisions subject to the approval of the supervisor and Division Head. At least one faculty core courses must be taken. To satisfy the Faculty core course requirement, students must achieve at least a grade B in the course. Otherwise, the course will only be counted as an elective.

Note 1: The University allows PhD students to take at most 15% of the course unit requirement at undergraduate level, which means, among the 21 units, at most 3 units can be at undergraduate level.

<u>Code</u>	<u>Course Title</u>	<u>Unit</u>
BMEG5100	Advanced Medical Robotics	3
BMEG5110	Advanced Medical Devices and Sensor Networks	3
BMEG5120	MEMS and Nanotechnology for Biomedical Engineering	3
BMEG5130	Biomedical Imaging Processing	3
BMEG5140	Rehabilitation Engineering	3
BMEG5210	Medical Visualization	3
BMEG5310	Biomedical Engineering Seminar I	1
BMEG5320	Biomedical Engineering Seminar II	1
BMEG5330	Biomedical Engineering Seminar III	1
BMEG5340	Biomedical Engineering Seminar IV	1
BMEG5610	Research Methods in Biomedical Engineering	3
CSCI5330	Advanced Algorithms for Bioinformatics	3
ELEG5120	Selected Topics in Biomedical Engineering	3
ELEG5130	Prosthetics and Artificial Organs	3
ELEG5140	Biomedical Informational Engineering	3
ENGG5404	Micromachining and Microelectromechanical Systems	3
MAEG5080	Smart Materials and Structures	3

Faculty Core Courses

ENGG5101	Advanced Computer Architecture	3
ENGG5103	Techniques for Data Mining	3
ENGG5104	Image Processing and Computer Vision	3
ENGG5105	Computer and Network Security	3
ENGG5106	Information Retrieval and Search Engines	3
ENGG5108	Big Data Analytics	3
ENGG5189	Advanced Artificial Intelligence	3
ENGG5202	Pattern Recognition	3
ENGG5281	Advanced Microwave Engineering	3
ENGG5282	Nanoelectronics	3
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ENGG5301	Information Theory	3
ENGG5302	Random Processes	3
ENGG5303	Advanced Wireless Communications	3
ENGG5383	Applied Cryptography	3
ENGG5392	Lightwave System Technologies	3
ENGG5402	Advanced Robotics	3
ENGG5403	Linear System Theory and Design	3
ENGG5404	Micromachining and Microelectromechanical Systems	3
ENGG5405	Theory of Engineering Design	3
ENGG5501	Foundations of Optimization	3
ENGG5601/	Principles of Biomechanics and Biomaterials	3
BMEG5150		
ENGG5781	Matrix Analysis and Computations	3

Student shall consult and obtain permission from the supervisor on course selection (the supervisor's signature on the course selection form is needed.)

Note:

- (1) Each lecture course normally carries three (3) units.
- (2) Each student will receive grades (A to F) every term for lecture courses. The pass grade for all courses is D or above.

(b) Thesis research / monitoring courses:

Each Ph.D. student must register for the relevant Thesis Research Course in every term throughout his/her study period.

- Full-time Ph.D. (pre-candidacy) students: BMEG8006
- Part-time Ph.D. (pre-candidacy) students: BMEG8003

Note:

- (1) BMEG8006 carries 6 units and BMEG8003 carries 3 units. Each unit should be regarded as equivalent to approximately 3 hours of study/research per week by the student.

- (2) Each student will receive grades (A to F) every term for Thesis Research courses. The pass grade for all courses is D or above.

2. *Other Requirements*

- (a) All students are required to attend IPL modules on "General Safety" and pass the corresponding examinations.
- (b) Complete an Improving Postgraduate Learning (IPL) module on "Introduction to Research & Thesis Writing For Engineering, Medicine & Science" in the first year of their study.

3. *Candidacy Examination*

- (a) Each Ph.D. student is required to pass a candidacy examination (CE) within the maximum period of his/her pre-candidacy stage for the advancement to his/her post-candidacy stage. The purpose of this examination is to test the student's basic knowledge and understanding in the BME discipline.

The CE is an open book, written examination. The student is required to answer a required number of questions selected by the supervisor.

- (b) At least 6 months before a student's written CE, the Division would inform the student a specific set of examination materials covering the underpinning knowledge of the student's field of research study. The materials may include textbooks, reference book chapters, review articles, and other major foundational publications.

The outcomes of a CE shall be stated as:

- Pass
- Conditional Pass with prescription of additional coursework
- Fail

The CE will be held every year. A student is required to pass a CE within the first two years of enrolment.

- (c) Instead of the CE as described above, a student with the endorsement of his/her thesis supervisor may also apply for permission to take the CE orally before an candidacy examination committee appointed by the BME Division in consultation with the student's supervisor. A student's candidacy examination committee shall normally consist of at least 3 members including a Chairman appointed by the Graduate Division Head. The student's supervisor shall not be included as a member of the candidacy examination committee of their own students. The composition of the candidacy examination committee shall be proposed by the student's chief supervisor, endorsed by the Graduate Division Head, and approved by the Graduate Panel.

During the oral CE, the candidacy examination committee members are expected to raise questions on the specific set of examination materials prescribed for the student, with the purpose to determine whether the student has an adequate mastery of the underpinning

knowledge for his/her field of research study. The duration of the oral CE is expected to last for 90 to 120 minutes normally.

Once such an application is approved by the BME Division and the collaborating home division, the student would not be able to revert back to take the written CE.

- (d) Instead of the CE as described above, A student with the endorsement of his/her thesis supervisor may also apply for permission to take the CE of the home division of his/her supervisor. Once such an application is approved by the BME Division and the collaborating home division, the student would not be able to revert back to take the BME CE. BME Division will accept the decision of the collaborating home division as final within the BME Division.
- (e) A student is required to discontinue from her/his Ph.D. study if the student fails twice in the Candidacy Examination.

4. *Thesis Proposal and Oral Defence*

- (a) Each Ph.D. student is required to pass a thesis proposal defence after 9 months and not later than 18 months from the date of his/her initial registration in the Ph.D. programme. The thesis proposal defence shall consist of a presentation open to the public and an oral proposal defence attended by the student's thesis proposal examination committee. (Note 4)
- (b) Each Ph.D. student is required to submit a formal progress report to his/her thesis proposal examination committee at least two weeks before the thesis proposal defence. The purpose of the thesis proposal defence is to assess the capability of the candidate for research work at the doctoral level.
- (c) The formal progress report and the thesis proposal defence will be assessed by the student's thesis proposal examination committee. The results of the examination of the thesis proposal and oral defence shall be stated as:
 - (a) Passed, or
 - (b) Required to take a second proposal defence, or
 - (c) Failed
- (d) A student is required to withdraw from his/her Ph.D. study if he/she fails the thesis proposal defence.

Note:

- (1) A "pass" of the thesis proposal defence means that the thesis proposal examination committee has found that the student is in possession of the research ability to complete the doctoral dissertation research. Failure to pass the defence may result in a requirement to withdraw from the programme.
- (2) The main purpose of the Thesis Proposal Defence is to assess the suitability of the candidate for research work at the doctoral level.
- (3) Each student in a Ph.D. programme is required to take the defence after 9 months and not later than 18 months from the date of the initial registration in the Ph.D. programme.
- (4) A student's thesis proposal examination committee shall normally consist of at least 3 members including the chief supervisor, and a Chairman appointed by the Graduate Division Head. The composition of the examination committee shall be proposed by the

chief supervisor, endorsed by the Graduate Division Head, and approved by the Graduate Panel.

- (5) The proposal defence shall consist of a presentation open to the public and an oral examination limited to the thesis proposal examination committee of the student. The presentation of the Thesis Proposal Defence should be announced to the public at least one week before the examination. If the performance of the candidate in the oral examination is deemed unsatisfactory by the examination committee, he/she will be requested to discontinue the study.

5. Remarks

(Applicable to students admitted in 2016-17 and before)

For the advancement to his/her post-candidacy stage, each Ph.D. student is required to pass:

- (a) at least 15 units of graduate courses,
- (b) the Candidacy Examination,
- (c) the thesis proposal defence,
- (d) The IPL module on "General Safety", and complete the IPL module on "Introduction to Research & Thesis Writing For Engineering, Medicine & Science".

(Applicable to students admitted in 2017-18 and thereafter)

For the advancement to his/her post-candidacy stage, each Ph.D. student is required to pass:

- (a) at least 15 units of graduate courses²,
- (b) the Candidacy Examination,
- (c) the thesis proposal defence,
- (d) The IPL module on "General Safety", and complete the IPL module on "Introduction to Research & Thesis Writing For Engineering, Medicine & Science".

Note 2: Students admitted in 2017-18 and thereafter can take at most 15% of the course unit requirement at undergraduate level, which can also be counted towards the course requirements for advancing to post-candidacy stage.

C. Ph.D. Student (Post-candidacy)

1. Coursework Requirement

- (a) Lecture courses:

(Applicable to students admitted in 2016-17 and before)

There is no additional course requirement for Ph.D. student.

(Applicable to students admitted in 2017-18 and thereafter)

Each Ph.D. student is required to complete the rest of 21 units of course requirement.

- (b) Thesis research / monitoring courses:

Each Ph.D. student must register for the relevant Thesis Research Course in every term through his/her study period.

- Full-time Ph.D. (post-candidacy) students: BMEG8012
- Part-time Ph.D. (post-candidacy) students: BMEG8006
- Continuing Ph.D. (post-candidacy) students: BMEG8003

Note: (1) BMEG8012 carries 12 units, BMEG8006 carries 6 units and BMEG8003 carries 3 units. Each unit should be regarded as equivalent to approximately 3 hours of study/research per week by the student.

2. Other Requirements

- (a) Students must fulfill the Term Assessment Requirement of the Graduate School. For details, please refer to Section 13.0 "Unsatisfactory Performance and Discontinuation of Studies" of the General Regulations Governing Postgraduate Studies which can be accessed from the Graduate School Homepage: <http://www.gs.cuhk.edu.hk>.
- (b) Students are required to submit a research thesis, and pass an oral examination for graduation.
- (c) Each student must present a graduate seminar.
- (d) Complete an Improving Postgraduate Learning (IPL) module on "Observing Intellectual Property and Copyright Law during Research". This is an online module and relevant information can be accessed from the website: <http://www.cuhk.edu.hk/clear/prodev/ipl.html>.
- (e) Students admitted in 2017-18 and thereafter are required to complete an online Research Ethics Training (RET) module on "Publication Ethics" offered by the Office of Research and Knowledge Transfer Services (ORKTS) and obtain a valid Publication Ethics Certificate for graduation. Relevant information can be accessed from the RET website at <https://www.research-ethics.cuhk.edu.hk/web/>.

Note:

- (1) Students are required to attend all Graduate Seminars of their own research group. If the number of Graduate Seminars of a research group is less than 6 in an academic year, then each student in the group is required to attend Graduate Seminars given by other research groups so that the total number of Graduate Seminars attended is 6 or above. The Department encourages students to attend more than 6 Graduate Seminars each year. Should they have difficulties in attending the seminars, please inform their supervisors and the lecturer-in-charge. Students who fail to do so without sufficient reasons will be reprimanded.
- (2) Postgraduate Studentship/Research Studentship holders are requested to fulfill their teaching duties as assigned by the Department satisfactorily. They are required to be present in the Department during normal office hours. They should post their duty timetables, and the consultation hours reserved for undergraduate students should be clearly marked. Students are urged to leave a note on their desk to indicate where they can be found if not in their office.
- (3) Postgraduate Studentship/Research Studentship holders are requested to seek approval

from their Supervisors in advance if they wish to take leave (14 calendar days annually). They should fill in a Leave Application Form (available from the General Office) which should be countersigned by their supervisors and the Graduate Division Head.

Study Scheme

Learning Outcomes

1. Our research programmes aim to educate researchers to embark on careers that would allow them to become world leaders in their fields, working as university professors, principal investigators in research institutes, senior managers in enterprises, or experts in other professions related to the pursuit and application of knowledge.
2. The University expects **doctoral degree graduates** of research programmes to have acquired in-depth knowledge in a number of major areas of an academic discipline while maintaining a broad understanding of other related fields. Doctoral degree graduates should have accumulated enough educational experience and background learning to be capable of performing independent research to advance scholarship, with global standards. In particular, doctoral graduates should have the ability to identify research trends and opportunities, venture into new research areas when appropriate, define long-term research objectives, formulate original research problems, and originate and develop solution methodologies. Doctoral graduates should be capable of producing research output at a level that can either lead to publications in high-ranking scholastic venues, or to novel applications in relevant industrial, commercial, or other public sectors, or to other forms of useful knowledge transfer to society. They should have gained proficiency in techniques of knowledge dissemination through presentation and writing and some teaching experiences through student tutoring.
3. The University expects **master's degree graduates** of research programmes to have acquired advanced knowledge in major areas of an academic discipline while maintaining a broad understanding of other related fields. Master's degree graduates should have gained enough background knowledge to enable them to perform research with minimal supervision. In particular, they should have the ability to formulate individual research tasks and to develop solution methodologies under minimal supervision. Master's degree graduates should be capable of producing original, innovative research output, some of which may lead to publication in well-respected scholastic venues. They should have gained proficiency in techniques of knowledge dissemination through presentation and writing.
4. For graduates of research programmes at both doctoral and master's level, communication and language skills at a level appropriate to university graduates are expected already at the time of admission. In particular, fluent communication skills are expected in the language(s) essential to their research areas. In general, a high level of proficiency in English is expected as it is commonly regarded as the default international research language. Ability in a second language is encouraged.

