

National Tsing Hua University

Department of Biomedical
Engineering & Environmental
Sciences

Regulations of Required Courses and

Credits

for

UNDERGRADUATE and

GRADUATE Students

2. Undergraduate Program

2-1 Course Selection Regulations

The Total Graduation Credits for UNDERGRADUATE Students in the Department of Biomedical Engineering & Environmental Sciences (BMES) are 128 credits. Students should take courses and receive credits based on the "Compulsory Courses and Total Graduation Credits" of their admission school year (Table 1 as an example for 108-year admission school year). For information about the "Compulsory Courses and Total Graduation Credits" of each admission school year, please visit the website of Division of Registration (<http://registra.site.nthu.edu.tw/p/404-1211-5139.php>) .

In addition to the 30 credits of **University Required Courses**, 60 credits of **Department Required Courses** (including 26 credits of Required Courses of Departments in the field of science and engineering and 34 credits of Required Courses of Department of BMES). One of the three specific fields "Molecular Biomedical Engineering and Materials", "Biomedical Imaging Engineering" or "Environmental Molecular Science" is required to choose for the 30 credits of **Professional Selective Courses** including 5 courses of Basic Science Elective Courses (15 credits) and Specialty Elective Courses (15 credits). As the remaining credits are for **Other Selective Courses**, students can choose courses of BMES or other Departments according to NTHU regulations. It is recommended that students discuss with their advisors before choosing courses. For other requirements for courses or academic degrees, please refer to "NTHU Regulations of Academic Affairs".

Table 1. Compulsory Courses and Total Graduation Credits of BMES for 108-year admission school year (example)

Category	Courses		Credits		Remarks
			First Semester	Second Semester	
University Required (30 credits) 校定必修 (30 學分)	College Chinese 大學中文		2		
	English 英文領域		8		Students who pass the English proficiency test can exempted from 2 credits of English courses
	General Education Courses 通識課程	Core courses required 核心必修	8-12		Select 4 of 6 dimensions, and take one course at lease in each of these 4 selected dimensions.
		Optional courses 選修課程	8-12		At least 2 credits for Social Science and Humanism
		Total 合計	20		
	Physical education 體育		0		Required Courses for 3 academic years
	Student Service 服務學習		0		Required for 60 hours
	Conduct 操行		0		Pass in each semester
Department Required (60 credits) 系定必修 (60 學分)	General Physics (I)(II) 普通物理一、二		4	4	
	General Physics Laboratory (I)(II) 普通物理實驗一、二		1	1	
	Calculus 微積分一、二		4	4	
	General Chemistry (I)(II) 普通化學一、二		3	3	
	General Chemistry Laboratory (I)(II) 普通化學實驗一、二		1	1	
	Engineering Mathematics (I)(II) 工程數學一、二		3	3	
	Introduction to Biomedical Engineering and Environmental Sciences 生醫工程與環境科學導論		2		
	Introduction to Atomic Science 原子科學導論		3		
	Probability and Statistics 機率與統計		3		
	Electronics (I) 電子學一		3		
	Organic Chemistry (I) 有機化學一		3		
	Introduction to Life Science 生命科學導論		3		
	Biochemistry (I) 生物化學一		3		
	Human Anatomy and Physiology 生理解剖學		3		
	Biomedical Electronics and Instrumentation Laboratory 生醫電子與儀器實驗		2		
	Biology and Biomedical Materials Laboratory 生物與材料實驗		2		
	Seminar 書報討論		1		
Professional Selective Courses (30 credits) 專業選修(30 學分)	Basic Science Elective Courses 基礎科學選修		15		
	Specialty Elective Courses 專長課程		15		
Other Selective Courses (8 Credits) 其餘選修(8 學分)			8		Students can choose courses of BMES or other Departments according to NTHU regulations. It is recommended to discuss with advisors before choosing courses.
Total Credits for Graduation 最低畢業總學分			128		
Note 備註	(1) Students who study BMES as a double major are required to take all of credits of Professional Selective Course of BMES. (2) 12 credits should be added to the total credits for students who graduated from the 5 academic system. For details, please contact the Department office.				

2-2 Professional Selective Courses 選修課程

Professional Selective Courses including 5 courses of (1) Basic Science Elective Courses (15 credits) and 5 courses of (2) Specialty Elective Courses (15 credits).

(1) Basic Science Elective Courses (5 courses, total 15 credits)

All five courses should belong to one of the three specific divisions: “Molecular Biomedical Engineering and Materials”, “Biomedical Imaging Engineering” or “Environmental Molecular Science”.

1. Molecular Biomedical Engineering and Materials Division

Courses	Credits
Molecular and Cellular Biology 分子細胞生物學	3
Molecular Genetics 分子遺傳學	3
Organic Chemistry 有機化學二	3
Biochemistry (II) 生物化學二	3
Biomedical Materials 生醫材料	3
Physical Chemistry (I) 物理化學一	3
Radiochemistry 放射化學	3

2. Biomedical Imaging Engineering Division

Courses	Credits
Biomedical Signals and Systems 生醫訊號與系統	3
Electromagnetism 電磁學	3
Modern Physics (I) 近代物理一	3
Radiation Physics 放射物理	3
Medical Instrumentation 醫學儀器	3
Introduction to Computer Science and Programming Language 計算機概論與程式語言	3
Numerical Methods 數值方法	3
Optics 光學	3
Radiation Detection and Measurement 輻射度量	3
Introduction of medical imaging 臨床醫學影像概論	3
Electronics II 電子學二	3

3. Environmental Molecular Science

Courses	Credits
Analytical Chemistry (I) 分析化學一	3
Analytical Chemistry (II) 分析化學二	3
Physical Chemistry (I) 物理化學一	3
Physical Chemistry (II) 物理化學二	3
Environmental Science and Engineering 環境科學與工程	3
Environment Chemistry 環境化學	3
Radiochemistry 放射化學	3

(2) Specialty Elective Courses (5 courses, total 15 credits)

15 credits are optional for non-general education courses with prefix 4 (inclusive) or above in BMES Department.

3. Master and Ph.D. Programs

3-1 Master Program

The curriculum plan for Master programs at BMES is based on the principle of expertise classification to design Professional Core Courses and Specialty Elective Courses, respectively, for the requirements of “Molecular Biomedical Engineering and Materials”, and “Biomedical Imaging Engineering”.

3-1-1 Course Requirement for Master Degree Program

1. Minimum Requirement Credits for Graduation: 24 credits (excluding thesis credits) including Basic Required Courses (6 credits), Professional Core Courses (at least 9 credits for 3 courses), and Specialty Elective Courses. For other requirements for courses or academic degrees, please refer to "NTHU Regulations of Academic Affairs".
2. Professional Core Courses: Students should select at least one Division of the Professional Core Courses, and take 3 courses from the selected Division.
3. Specialty Elective Courses: Students should select courses with a prefix of 4 or higher which are related to their own thesis research field. A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses, and General Education Courses are excluded. If the courses outside the department are taken as "Specialty Elective Courses", they need to be approved by the advisor through the application form (attached Table 2) with the advisor signature to the Department office.
4. Internship in Hospital is offered in summer vacation. Students who intend to take the internship course need to submit the application before the end of March for every academic year. After approved by the Department Chair, they can be admitted into the internship training course.
5. Students should complete the course “Academic Research Ethics Education” in the first school year. This course is offered online, and students should pass the examination before graduation.

Basic Required Courses

Academic Research Ethics Education (0 credit × 1 semester, should complete in the first school year)

Seminar (1 credit × 2 semester)

Seminar: Molecular Biomedical Engineering and Materials or Seminar: Biomedical Imaging

Engineering (1 credit $\times$ 2 semester)

Colloquium (0 credit $\times$ 4 semester)

MS Graduate Research (I) (1 credit $\times$ 1 semester)

MS Graduate Research (II) (1 credit $\times$ 1 semester)

Professional Core Courses

Molecular Biomedical Engineering and Materials Division		
Fundamentals of Biophotonics (3)	The Biotechnology and Application of Photoelectronics (3)	Introduction to Molecular Biomedicine (3)
Radiation Biology (3)	Bioconjugated Chemistry (3)	Molecular Imaging Pharmaceuticals (3)
Gene Chips and Its Biomedical Applications (3)	Biomedical Epidemiology and Environmental Toxicology (3)	Stem Cell and Tissue Engineering (3)
Biomedical Composites and Surface Modification (3)	Drug Controlled Release (3)	Introduction to Nanobiotechnology (3)
Design and Application of Organ on a Chip and Bioartificial Organ (3)	Biomedical Sensors (3)	

Biomedical Imaging Engineering Division		
Radiation Physics (3)	Biomedical Image Processing (3)	Principles of Medical Ultrasonics (3)
Magnetic Resonance Imaging Principles and Applications (3)	Biomedical Signal Processing (3)	Physiological Magnetic Resonance Imaging (3)
Deep Learning in Biomedical Image Analysis (3)	Digital Biomedical Microscopy Technology (3)	Fundamentals of Biophotonics (3)
Design of Wearable Biomedical Electronic Device(3)		

Specialty Elective Courses

Students should select courses with a prefix of 4 or higher which are related to their own thesis research field. A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses, and General Education Courses are excluded. If the courses outside the department are taken as "Specialty Elective Courses", they need to be approved by the advisor through the application form (attached Table 2) with the advisor signature to the Department office.

3-2 Ph.D. Program

The curriculum plan for Ph.D. programs at BMES is based on the principle of expertise classification to design Professional Core Courses and Specialty Elective Courses, respectively, for the requirements of “Molecular Biomedical Engineering and Materials”, and “Biomedical Imaging Engineering”.

3-2-1 Requirement for Ph.D. Candidates

To become a Ph.D. candidate, the student must fulfill the following requirements:

1. Completed the required courses and credits for Ph.D. program.
2. Passed the Ph.D. Qualifying Exam.

3-2-1-1 Course Requirement for Ph.D. Program

Students should select at least one Division of the Professional Core Courses and take 3 courses from the selected Division. Students with MS Degree from BMES, NTHU may be exempted from this requirement after discussion with their thesis advisor.

1. Minimum Credits Requirement for Graduation: 24 credits (excluding thesis credits), 36 credits (excluding thesis credits) for BS students who study straight into Ph.D. degree.
2. Professional Core Courses: Students should select at least one Division of the Professional Core Courses, and take 3 courses in the selected Division.
3. Specialty Elective Courses: Students should select courses with a prefix of 4 or higher which are related to their own thesis research field. A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses, and General Education Courses are excluded. If the courses outside the department are taken as "Specialty Elective Courses", they need to be approved by the advisor through the application form (attached Table 2) with the advisor signature to the Department office.
4. Internship in Hospital is offered in summer vacation. Students who intend to take the internship course need to submit the application before the end of March for every academic year. After approved by the Department Chair, they can be admitted into the internship training course.

5. Students should complete the course “Academic Research Ethics Education” in the first school year. This course is offered online, and students should pass the examination before graduation.

Basic Required Courses

Academic Research Ethics Education (0 credit $\times$ 1 semester, should complete in the first school year)

Seminar (1 credit $\times$ 4 semester)

Colloquium (0 credit $\times$ 4 semester)

PhD Graduate Research (I) (1 credit $\times$ 1 semester)

PhD Graduate Research (II) (1 credit $\times$ 1 semester)

Professional Core Courses

Molecular Biomedical Engineering and Materials Division		
Fundamentals of Biophotonics (3)	The Biotechnology and Application of Photoelectronics (3)	Introduction to Molecular Biomedicine (3)
Radiation Biology (3)	Bioconjugated Chemistry (3)	Molecular Imaging Pharmaceuticals (3)
Gene Chips and Its Biomedical Applications (3)	Biomedical Epidemiology and Environmental Toxicology (3)	Stem Cell and Tissue Engineering (3)
Biomedical Composites and Surface Modification (3)	Drug Controlled Release (3)	Introduction to Nanobiotechnology (3)
Design and Application of Organ on a Chip and Bioartificial Organ (3)	Biomedical Sensors (3)	

Biomedical Imaging Engineering Division		
Radiation Physics (3)	Biomedical Image Processing (3)	Principles of Medical Ultrasonics (3)
Magnetic Resonance Imaging Principles and Applications (3)	Biomedical Signal Processing (3)	Physiological Magnetic Resonance Imaging (3)
Deep Learning in Biomedical Image Analysis (3)	Digital Biomedical Microscopy Technology (3)	Fundamentals of Biophotonics (3)
Design of Wearable Biomedical Electronic Device(3)		

- * Students, whose thesis advisor are mainly affiliated with the Institute of Analysis and Environmental Sciences NTHU, are allowed to select the Professional Core Courses offered by the Institute of Analysis and Environmental Sciences NTHU.

Specialty Elective Courses

Students should select courses with a prefix of 4 or higher which are related to their own thesis research field. A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses. General Education Courses are excluded.

3-2-1-2 Course Requirement for Industrial Ph.D. Students

Students should select at least one Division from the Professional Core Courses and take 3 courses from the selected Division. Students with MS Degree from the Department of Biomedical Engineering & Environmental Sciences, NTHU may be exempted from this requirement after discussion with their thesis advisor.

1. Minimum Credits Requirement for Graduation: 24 credits (excluding thesis credits), 36 credits (excluding thesis credits) for BS students who study straight into Ph.D. degree.
2. Professional Core Courses: Students should select at least one Division of the Professional Core Courses, and take 3 courses in the selected Division.
3. Specialty Elective Courses: Students should select courses with a prefix of 4 or higher which are related to their own thesis research field.-A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses, and General Education Courses are excluded. If the courses outside the department are taken as "Specialty Elective Courses", they need to be approved by the advisor through the application form (attached Table 2) with the advisor signature to the Department office.
4. Internship in Hospital is offered in summer vacation. Students who intend to take the internship course need to submit the application before the end of March for every academic year. After approved by the Department Chair, they can be admitted into the internship training course.
5. Students should complete the course “Academic Research Ethics Education” in the first school year. This course is offered online, and students should pass the examination before graduation.

Basic Required Courses

Academic Research Ethics Education (0 credit $\times$ 1 semester, should complete in the first school year)

Seminar (1 credit $\times$ 4 semester)

Colloquium (0 credit $\times$ 4 semester)

PhD Graduate Research (I) (1 credit $\times$ 1 semester)

PhD Graduate Research (II) (1 credit $\times$ 1 semester)

Professional Core Courses

Molecular Biomedical Engineering and Materials Division		
Fundamentals of Biophotonics (3)	The Biotechnology and Application of Photoelectronics (3)	Introduction to Molecular Biomedicine (3)
Radiation Biology (3)	Bioconjugated Chemistry (3)	Molecular Imaging Pharmaceuticals (3)
Gene Chips and Its Biomedical Applications (3)	Biomedical Epidemiology and Environmental Toxicology (3)	Stem Cell and Tissue Engineering (3)
Biomedical Composites and Surface Modification (3)	Drug Controlled Release (3)	Introduction to Nanobiotechnology (3)
Design and Application of Organ on a Chip and Bioartificial Organ (3)	Biomedical Sensors (3)	

Biomedical Imaging Engineering Division		
Radiation Physics (3)	Biomedical Image Processing (3)	Principles of Medical Ultrasonics (3)
Magnetic Resonance Imaging Principles and Applications (3)	Biomedical Signal Processing (3)	Physiological Magnetic Resonance Imaging (3)
Deep Learning in Biomedical Image Analysis (3)	Digital Biomedical Microscopy Technology (3)	Fundamentals of Biophotonics (3)
Design of Wearable Biomedical Electronic Device(3)		

Specialty Elective Courses

Students should select courses with a prefix of 4 or higher which are related to their own thesis research field. A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses, and General Education Courses are excluded. If the courses outside the department are taken as "Specialty Elective Courses", they need to be approved by the advisor through the application form (attached Table 2) with the advisor signature to the Department office.

Table 2 附表二

生醫工程與環境科學系 碩博士班『專長選修課程』修習系外課程申請表
Application Form for Ex-Department Courses for Master's and Doctoral Programs in the Department of Biomedical Engineering and Environmental Sciences "Specialty Elective Courses"

110.3.19 系務會議修訂

2021.3.19 Dept. issued

學生姓名 Student Name: _____

學號 Student ID No.: _____

請填寫修習系外課程之課程名稱 (學生自行填寫)

Please fill in the name of the courses taken outside the department (Fill in by yourself)

科號 Course No.	開課科系 Department of Course	課程名稱 Name of Course	預計修習學期 (如：109 學年上學 期) Semester Year

※備註：

根據生醫工程與環境科學系學位手冊(第六版)規定

- 『專長選修課程』為『基礎必修課程』和『專業核心課程』以外之剩餘最低畢業學分。
- 『專長選修課程』為系內或系外課程中選修與論文研究領域相關之 4 (含) 字頭以上非通識課程，4 字頭課程以二門為上限。
- 唯修習系外課程作為『專長選修課程』，需指導教授認可。請填妥此申請表，經指導教授簽名後送交系辦公室存查。
- 繳交期限：學期開始至加退選結束前。

- "Specialty Elective Courses" are the minimum remaining graduation credits other than "Basic Required Courses" and "Professional Core Courses".
- Students should select "Specialty Elective Courses" with a prefix of 4 or higher which are related to their own thesis research field. A maximum of 2 courses with prefix 4 are allowed to include into the Specialty Elective Courses, and General Education Courses are excluded.
- If the courses outside the department are taken as "Specialty Elective Courses", they need to be approved by the advisor through this application form with the advisor signature to the Department office.
- Application deadline: from the beginning of the semester to before the end of the addition or withdrawal.

指導教授簽名 Signature of Advisor: _____

學生簽名 Signature of student: _____

日期 Date: _____