Publications Registration Number
UNIST–Educational Affairs Team–2020–002

2020

ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

# UNDERGRADUATE COURSE CATALOG

UNIST

ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

2020 UNDERGRADUATE COURSE CATALOG

UNIST

**2020 UNDERGRADUATE COURSE CATALOG**

UNIST
ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

| | |
|---|---|
| Date of Issue | Jan. 28, 2020 |
| Publishing Office | UNIST Educational Affairs Team |
| Contact Information | Tel. 052–217–1111~8 Fax. 052–217–1119 |
| Address | 50 UNIST–gil, Eonyang–eup, Ulju–gun, Ulsan |
| Website | http://www.unist.ac.kr |

# 2020

# UNDERGRADUATE COURSE CATALOG

# UNIST
# Vision and Goal

## VISION

**World Leading University to Advance Science and Technology for the Prosperity of Humankind**

Cultivating creative global leaders who will usher in new scientific paradigms
through convergence in science and technology

## GOALS

**To be Ranked within the Top 10 Science and Technology University by 2030**

**Education**
Cultivation of creative leaders that excel in science and technology

**Research**
Realization of convergence science and technology, indicating the new paradigm

## STRATEGIES

**Creativity, Interdisciplinary Education, Globalization, and Research-Intensive**

**Creativity**
IT-based student-centered discussion classes

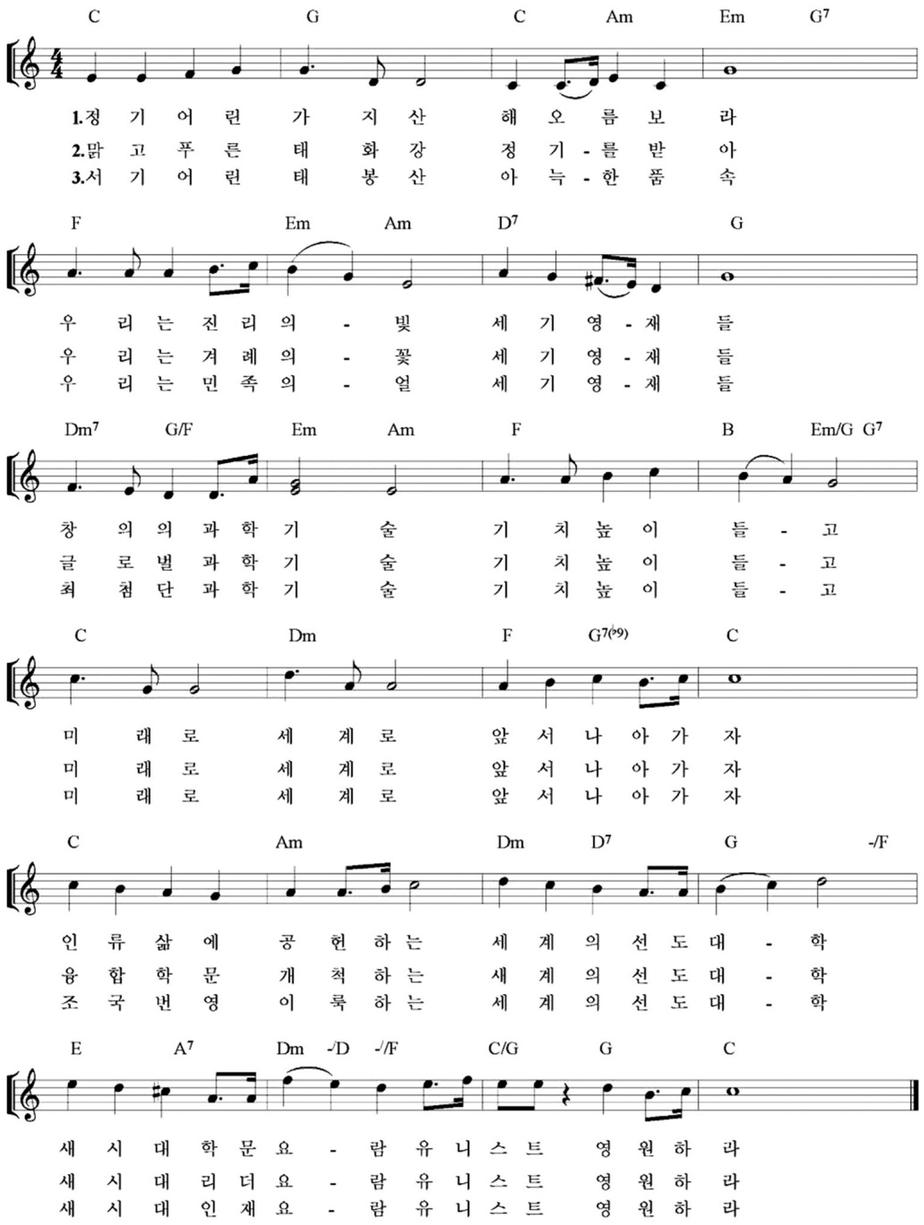
**Interdisciplinary Education**
Mandatory requirement to complete two or more areas of concentration
All professors are appointed to undertake two or more schools

**Globalization**
All courses at UNIST are conducted in 100% English
Expansion of foreign professors and students by 20%

**Research Intensive**
Research topics for thrust area
- Next-Generation Energy
- Advanced Materials

# 교 가

박종해 글
김준범 곡




# 2020 UNIST ACADEMIC CALENDAR

| Year | Month | Date | Schedules |
|---|---|---|---|
| 2020 Spring Semester | 3 | 1(Sun) | Holiday - Samiljeol (Independence Movement Day)<br>**2020 Spring Semester Begins** |
| | | 2(Mon) | **2020 Spring semester classes begin** |
| | | 2(Mon) ~ 6(Fri) | Course Changes and confirmation |
| | | 27(Fri) | End of first quarter of the semester |
| | 4 | 15(Wed) | Holiday - 21th National Assembly election |
| | | 20(Mon) ~ 24(Fri) | Mid-term Exams |
| | | 24(Fri) | End of second quarter of the semester,<br>Submission deadline for Courses List of the summer session,<br>Leave of Absence application deadline (General) |
| | | 30(Thu) | Holiday - Buddha's birthday |
| | 5 | 5(Tue) | Holiday - Children's Day |
| | | 18(Mon) ~ 20(Wed) | Return application for the summer session |
| | | 22(Fri) | End of third quarter of the semester<br>[Graduate school]<br>Deadline for 'Nomination of Thesis Committee' submission |
| | | 25(Mon) ~ 26(Tue) | [Graduate school] Course Registration for the summer session |
| | | 25(Mon) ~ 29(Fri) | [Undergraduate school] Application for Interdisciplinary major |
| | | 27(Wed) ~ 28(Thu) | [Undergraduate school] Course Registration for the summer session |
| | 6 | 6(Sat) | Holiday - Memorial Day |
| | | 15(Mon) ~ 19(Fri) | Final Exams |
| | | 19(Fri) | The end of spring semester |
| | | 20(Sat) ~ 8.30(Sun) | Summer Vacation |
| | | 22(Mon) ~ 7.31(Fri) | Summer Session |
| | 7 | 6(Mon) | Due date for grading |
| | | 6(Mon) ~ 10(Fri) | Leave of absence/Return application for the fall semester<br>[Graduate school] Submit the application for the program change |
| | | 30(Thu) ~ 31(Fri) | Undergraduate Course Registration for the fall semester |
| | 8 | 10(Mon) | Due date for summer session grading |
| | | 13(Thu) ~ 14(Fri) | [Graduate school] Course Registration for the fall semester |
| | | 15(Sat) | Holiday - National Liberation Day |
| | | 21(Fri) | Conferral of degrees |
| | | 25(Tue) ~ 27(Thu) | Tuition fee payment for the fall semester |

| Year | Month | Date | Schedules |
|---|---|---|---|
| 2020 Fall Semester | 8 | 31(Mon) | **2020 Fall semester begins**<br>**2020 Fall semester classes begin** |
| | | 31(Mon) ~ 9.4(Fri) | Course changes and confirmation |
| | 9 | 25(Fri) | End of first quarter of the semester |
| | | 28(Mon) | Holiday - UNIST Foundation Day |
| | | 30(Wed)~ 10.2(Fri) | Holiday - Chuseok (Korean Thanksgiving Day) |
| | 10 | 3(Sat) | Holiday - National Foundation Day |
| | | 9(Wed) | Holiday - Hangul Proclamation Day |
| | | 19(Mon) ~ 23(Fri) | Mid-term exams |
| | | 23(Fri) | End of second quarter of the semester,<br>Submission deadline for Courses List of the winter session<br>Leave of Absence application deadline (General) |
| | 11 | 16(Mon) ~ 18(Wed) | Return application for the winter session |
| | | 20(Fri) | End of third quarter of the semester<br>[Graduate school]<br>Deadline for 'Nomination of Thesis Committee' submission |
| | | 23(Mon) ~ 24(Tue) | [Graduate school] Course Registration for the winter session |
| | | 23(Mon) ~ 27(Fri) | Application for Interdisciplinary major |
| | | 25(Wed) ~ 26(Thu) | [Undergraduate school]Course Registration for the winter session |
| | 12 | 14(Mon) ~ 18(Fri) | Final Exams |
| | | 18(Fri) | The end of fall semester |
| | | 19(Sat) ~ 2021.2.28(Sun) | Winter Vacation |
| | | 25(Fri) | Holiday - Christmas |
| | | 28(Mon) ~ 2021.2.5(Fri) | Winter Session |
| 2021 | 1 | 1(Wed) | Holiday - New Year's Day |
| | | 4(Mon) | Due date for grading |
| | | 4(Mon) ~ 8(Fri) | [Graduate school] Submit the application for the program change<br>Leave of absence/Return application for the spring semester, 2021 |
| | | 28(Thu) ~ 29(Fri) | Undergraduate Course Registration for the spring semester, 2021 |
| | 2 | 11(Thu)~13(Sat) | Holiday - Lunar New Year's Day |
| | | 15(Mon) | Due date for winter session grading |
| | | 15(Mon)~16(Tue) | [Graduate school] Course Registration for the spring semester, 2021 |
| | | 18(Thu) | Commencement Ceremony |
| | | 23(Tue) ~ 25(Thu) | Tuition fee payment for the spring semester, 2021 |

※ Schedules above are subject to change according to the school policies.

# SCHOOL ADMINISTRATIVE OFFICE

## [ 각 학부행정실 연락처 ]

| School | Office Information | |
|---|---|---|
| | Contact (052-217) | Office Location |
| 기계항공및원자력공학부<br>School of Mechanical, Aerospace and Nuclear Engineering | 3506 | EB5 (#112) Rm. 401-14 |
| 도시환경공학부<br>School of Urban and Environmental Engineering | 3644 | EB4 (#110) Rm. 901-14 |
| 디자인및인간공학부<br>School of Design and Human Engineering | 3563 | EB2 (#104) Rm. 901-10 |
| 신소재공학부<br>School of Materials Science and Engineering | 3525 | EB1 (#102) Rm. 601-10 |
| 에너지및화학공학부<br>School of Energy and Chemical Engineering | UG: 3542<br>G: 3547 | EB2 (#104) Rm. 401-10 |
| 전기전자컴퓨터공학부<br>School of Electrical and Computer Engineering | UG: 3627<br>G: 3622 | EB3 (#106) Rm. 301-8 |
| 생명과학부<br>School of Life Sciences | 3585 | EB4 (#110) Rm. 601-14 |
| 자연과학부<br>School of Natural Science | 3603<br>3606 | NSB (#108) Rm. 701-12 |
| 경영학부<br>School of Business Administration | 3665 | BAB (#114) Rm. 601 |
| 경영공학부<br>School of Management Engineering | 6802 | BAB (#114) Rm. 507 |
| 기초과정부<br>Division of General Studies | 3687 | BAB (#114) Rm. 506-13 |
| 새내기지원센터<br>Freshmen Support Center | 6702<br>6704 | BAB (#114) Rm.308-8<br>BAB (#114) Rm.308-8 |

*UG: Undergraduate (학부), G: Graduate (대학원)

# Undergraduate

# Undergraduate Contents

# Required Credit for Graduation

## □ Engineering Field (이공계열)

| | | | | | |
|---|---|---|---|---|---|
| **Major** | **Major** | 1st Track/2nd Track | | 54/18 | 75 |
| | | Internship | | 3 | |
| | | Interdisciplinary Project | | P | |
| **Funda mental** | **Math & Science** | Calculus Ⅰ / Calculus Ⅱ | | 6 | 40 |
| | | Differential Equations/Applied Linear Algebra/Statistics : Choose two | | 6 | |
| | | General Physics Ⅰ, Ⅱ | | 6 | |
| | | General Physics Lab Ⅰ, Ⅱ | | 2 | |
| | | General Chemistry Ⅰ, Ⅱ | | 6 | |
| | | General Chemistry Lab Ⅰ, Ⅱ | | 2 | |
| | | General Biology | | 3 | |
| | **IT** | Introduction to AI Programming Ⅰ | | 3 | |
| | | Introduction to AI Programming Ⅱ | | 3 | |
| | **MGT** | Entrepreneurship & Big Data | | 3 | |
| **Liberal Arts** | **English** | Level 1 | UNIST English Camp or English Camp (Non credit course) | 4 | 24 |
| | | | English Listening & Speaking (Intermediate) | | |
| | | | English Reading & Writing | | |
| | | Level 2 | English Listening & Speaking (Intermediate) | | |
| | | | English Reading & Writing | | |
| | | Level 3 | English Listening & Speaking (Advanced) | | |
| | | | English Reading & Writing | | |
| | | Level 4 | Choose 2 ENG2** Courses | | |
| | **Language** | Chinese Foundation | Choose one | 2 | |
| | | Chinese Forward | | | |
| | | Spanish Foundation | | | |
| | **AHS** | Choose six courses among Liberal Arts Category | Choose over six | 18 | |
| **Free Elective*** | | | | | 3 |
| **Leadership** | **ULP** | UNIST Leadership Program | | | 8AU |
| **Total 142 credits / 8AU** | | | | | |

*Applies to all students

## ☐ Business Administration Field (경영계열)

| | | | | | |
|---|---|---|---|---|---|
| **Major** | **Major** | 1st Track/2nd Track | | 54/18 | 75 |
| | | Internship | | 3 | |
| | | Interdisciplinary Project | | P | |
| **Funda mental** | **Math & Science** | Calculus Ⅰ | | 3 | 30 |
| | | Applied Linear Algebra / Statistics | | 6 | |
| | | General Physics | | 3 | |
| | | General Chemistry | | 3 | |
| | | General Biology | | 3 | |
| | **IT** | Introduction to AI Programming Ⅰ | | 3 | |
| | | Introduction to AI Programming Ⅱ | | 3 | |
| | **MGT** | Entrepreneurship & Big Data | | 3 | |
| | | Economics | | 3 | |
| **Liberal Arts** | **English** | Level 1 | UNIST English Camp or English Camp (Non credit course) | 4 | 24 |
| | | | English Listening & Speaking (Intermediate) | | |
| | | | English Reading & Writing | | |
| | | Level 2 | English Listening & Speaking (Intermediate) | | |
| | | | English Reading & Writing | | |
| | | Level 3 | English Listening & Speaking (Advanced) | | |
| | | | English Reading & Writing | | |
| | | Level 4 | Choose 2 ENG2** Courses | | |
| | **Language** | Chinese Foundation | Choose one | 2 | |
| | | Chinese Forward | | | |
| | | Spanish Foundation | | | |
| | **AHS** | Choose six courses among Liberal Arts Category | Choose over six | 18 | |
| **Free Elective*** | | | | | 12 |
| **Leadership** | **ULP** | UNIST Leadership Program | | | 8AU |
| **Total 141 credits / 8AU** | | | | | |

*Applies to all students



## ☐ Interdisciplinary Project

This course is joined with other tracks for completing a term project through collaboration. Students are required to conceive of a novel idea, which will be realized by designing and fabricating a product by using the best knowledge acquired at the undergraduate level.

▶ How-to :

- Apply for the Interdisciplinary Project on Portal site during the course registration period
- Consult with the advisor you selected for the subject of the Interdisciplinary Project
- Evaluation will be implemented with a experiment report, a poster, a presentation, etc.

▶ Credit : non-credit (P/F)

* Old Curriculum Students(09~13): Portal Application(0 Credit) + Course Registration(2 Credits - 1 credit each track)

## ☐ Internship

▶ All students must complete at least 3 credits of Internship.

| Section | Research Internship | Industry Internship | Venture Creation Internship |
|---|---|---|---|
| **Common requirement** | - Requirement for graduation(3 Internship credit as major)<br>- Possible to get 3 credits by mixing internships<br>※ Research, Industry, Venture creation | | |

* Students who only take research internship should complete each school industrial replacement program

## ☐ English Qualification Test

▶ Requirements for an English Qualification Test

| Test | TOEFL (IBT) | TOEIC | TEPS[1)] | NEW TEPS | IELTS | TOEIC S&W | G-TELP (Lev.2) | G-TELP (Lev.3) |
|---|---|---|---|---|---|---|---|---|
| **Score** | 80 | 800 | 640 | 350 | 6.5 | 250(09~13)<br>270(14~) | 67 | 89 |

1) Shall be applied to the tests until No.248 TEPS(2018.05.12.).

## ☐ Credit Requirement for Each track

| School | Track | Interdisciplinary Major (Required/Elective) | | | | Dual Major | | |
|---|---|---|---|---|---|---|---|---|
| | | 1TR | 2TR | Total | | Dual Major | Total | |
| | | | | 1Tr | 2Tr | | 1TR | Dual |
| Mechanical, Aerospace and Nuclear Engineering | Mechanical and Aerospace Engineering (MAE) | 33/21 | 9/9 | 54 | 18 | 33/15 | 54 | 48 |
| | Nuclear Science and Engineering (NSE) | 33/21 | 3/15 | 54 | 18 | 33/15 | 54 | 48 |
| | System Design and Control Engineering (SDC) | 24/30 | 0/18 | 54 | 18 | 24/24 | 54 | 48 |
| Urban and Environmental Engineering | Environmental Science and Engineering (ESE) | 6/48 | 6/12 | 54 | 18 | 6/42 | 54 | 48 |
| | Urban Infrastructure Engineering (UIE) | 18/36 | 9/9 | 54 | 18 | 18/30 | 54 | 48 |
| | Disaster Management Engineering (DME) | 18/36 | 9/9 | 54 | 18 | 18/30 | 54 | 48 |
| Design and Human Engineering | Industrial Design (ID) | 33/21 | 0/18 | 54 | 18 | 33/15 | 54 | 48 |
| | Human Factors Engineering (HFE) | 24/30 | 0/18 | 54 | 18 | 24/24 | 54 | 48 |
| Materials Science and Engineering | Advanced Materials Science (AMS) | 15/39 | 3/15 | 54 | 18 | 15/33 | 54 | 48 |
| | Semiconductor Materials Engineering (SE) | 15/39 | 3/15 | 54 | 18 | 15/33 | 54 | 48 |
| Energy and Chemical Engineering | Energy Engineering (ENE) | 31/23 | 12/6 | 54 | 18 | 31/17 | 54 | 48 |
| | Chemical Engineering (ACE) | 28/26 | 15/3 | 54 | 18 | 28/20 | 54 | 48 |
| Electrical and Computer Engineering | Electrical Engineering (EE) | 36/18 | 12/6 | 54 | 18 | 36/12 | 54 | 48 |
| | Computer Science & Engineering (CSE) | 33/21 | 3/15 | 54 | 18 | 33/15 | 54 | 48 |
| Life Sciences | Biological Sciences (BIO) | 23/31 | 15/3 | 54 | 18 | 23/25 | 54 | 48 |
| | Biomedical Engineering (BME) | 30/24 | 12/6 | 54 | 18 | 30/18 | 54 | 48 |
| Natural Science | Physics (PHY) | 36/18 | 12/6 | 54 | 18 | 36/12 | 54 | 48 |
| | Chemistry (CHEM) | 33/21 | 12/6 | 54 | 18 | 33/15 | 54 | 48 |
| | Mathematical Sciences (MTH) | 33/21 | 12/6 | 54 | 18 | 33/15 | 54 | 48 |
| Business Administration | Management (MGT) | 21/33 | 15/3 | 54 | 18 | 21/27 | 54 | 48 |
| | Finance & Accounting (FIA) | 24/30 | 12/6 | 54 | 18 | 24/24 | 54 | 48 |
| | Entrepreneurship (EPS)[1)] | -/- | 12/6 | 0 | 18 | -/- | 54 | 48 |
| Management Engineering | Management Engineering (MGE) | 24/30 | 9/9 | 54 | 18 | 24/24 | 54 | 48 |

1) Students can choose EPS track only as a 2nd track, not for the 1st track.

## ☐ Degree conferred for Each Track

| School | Degree | Track | Remark |
|---|---|---|---|
| School of Mechanical, Aerospace and Nuclear Engineering 기계항공및원자력공학부 | B.S. in Mechanical, Aerospace and Nuclear Engineering 공학사 | Mechanical and Aerospace Engineering (MAE) 기계항공공학 | |
| | | Nuclear Science and Engineering (NSE) 원자력 공학 및 과학 | |
| | | System Design and Control Engineering (SDC) 제어설계공학 | |
| School of Urban and Environmental Engineering 도시환경공학부 | B.S. in Urban and Environmental ngineering 공학사 or 이학사 | Environmental Science and Engineering (ESE) 환경과학공학 | |
| | | Urban Infrastructure Engineering (UIE) 도시건설공학 | |
| | | Disaster Management Engineering (DME) 재난관리공학 | |
| School of Design and Human Engineering 디자인및인간공학부 | B.S. in Design and Human Engineering 공학사 | Industrial Design (ID) 산업디자인 | |
| | | Human Factors Engineering (HFE) 인간공학 | |
| School of Materials Science and Engineering 신소재공학부 | B.S. in Materials Science and Engineering 공학사 | Advanced Materials Science (AMS) 첨단소재과학 | |
| | | Semiconductor Materials Engineering (SE) 반도체재료공학 | |
| School of Energy and Chemical Engineering 에너지및화학공학부 | B.S. in Energy and Chemical Engineering 공학사 | Energy Engineering (ENE) 에너지공학 | |
| | | Chemical Engineering (ACE) 화학공학 | |
| School of Electrical and Computer Engineering 전기전자컴퓨터공학부 | B.S. in Electrical and Computer Engineering 공학사 | Electrical Engineering (EE) 전기 및 전자공학 | |
| | | Computer Science and Engineering (CSE) 컴퓨터공학 | |
| School of Life Sciences 생명과학부 | B.S. in Biological Sciences 이학사 | Biological Sciences (BIO) 생명과학 | |
| | B.S. in Biomedical Engineering 공학사 | Biomedical Engineering (BME) 생명공학 | |
| School of Natural Science 자연과학부 | B.S. in Natural Science 이학사 | Physics (PHY) 물리학 | |
| | | Chemistry (CHEM) 화학 | |
| | | Mathematical Sciences (MTH) 수리과학 | |
| School of Business Administration 경영학부 | Bachelor of Business Administration (B.B.A.) 경영학사 | Management (MGT) 경영학 | |
| | | Finance & Accounting (FIA) 재무 · 회계학 | |
| | | Entrepreneurship (EPS) 벤처경영 | |
| School of Management Engineering 경영공학부 | B.S. in Management Engineering 공학사 | Management Engineering (MGE) 경영공학 | |

# Division of General Studies

## 1. School Introduction

The Division of General Studies (DGS) is central to the mission of UNIST, providing the education for creative engineering, global leadership, and trans-disciplinary, integrative knowledge for contributing to the future of humankind. Liberal arts and basic science courses enable students to attain higher levels of thinking, analyzing and understanding the wider world, while IT and English courses provide the tools for making a global impact. Upon successful completion of the freshmen curriculum at DGS, each student may choose two specialized fields (departments/tracks) in accordance with the UNIST regulation for advancement into the major fields of study.

## 2. Undergraduate Programs

### 1) Math & Science

The Math & Science area is designed to provide a solid basic knowledge in the students' specialties by offering General Science courses like Mathematics, Physics, Chemistry, Biology,
and also enabling students to study more effectively and efficiently by harmonizing theoretical studies and laboratory works.

### 2) IT

The IT area is designed to teach the basic knowledge of computer programming, practical IT skills, and the applications and potential of IT. For engineering students, the topics are: the basics of computer programming and how to formulate solutions for existing engineering problems by numerous case studies, through lectures and laboratory practices. For students of management majors, the concepts, operations and application of information systems for business purposes are presented. A number of courses are offered to help students understand and use fundamental computer system principles, so that they will function more efficiently and effectively as future engineers and managers.

### 3) Management

Management is focused on cultivating fundamental knowledge of Business Administration by offering courses like Innovation and Entrepreneurship and Economics.



### 4) English

The main goal of the English courses is to cultivate fundamental knowledge of English. Students, according to their English proficiency, will take two English courses which provide the students with opportunities to acquire not only comprehension skills, such as listening and reading, but also production skills like speaking and writing. Students will participate in student-centered learning by means of on-line materials and in class meetings with instructors. Upon completion of the required English courses, students will advance to elective English courses that focus on uses of English appropriately by styles, culture, and context.

### 5) Language

The main goal is to educate global citizens by cultivating fundamental knowledge of languages other than English. Courses offered are Chinese Foundation and Chinese Forward, and try to increase the students' interests through various teaching methods.

### 6) AHS (Arts, Humanities & Social Sciences)

Various AHS courses are offered to increase the creative power of engineering and business students. In these courses, the students will also acquire basic knowledge in AHS areas by the means of discussions, presentations, and LMS (Learning Management System) which set them apart from the general education courses at other universities.

### 7) UNIST Leadership Program (belongs to the Leadership Center)

The goal of the Leadership Program is to build up students' character as UNISTARS with characteristics such as honesty, sincerity, cooperative spirit, mutual respect, etc. through participation in team activities following a creative planning process. It also aims to foster students' leadership qualities such as discussion skills, presentation skills, ability to organize and operate a team, and mentoring juniors, etc.

## 3. Curriculum ※ Opening courses are subject to change

### □ Fundamental

| Category | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| M&S | MTH111 | Calculus Ⅰ<br>미적분학 Ⅰ | 3-3-1 | | 1 |
| | MTH112<br>(MTH114) | Calculus Ⅱ (Advanced Calculus Ⅱ)<br>미적분학 Ⅱ (고급미적분학 Ⅱ) | 3-3-1<br>(3-3-0) | ()is a honor course | 2 |
| | MTH201 | Differential Equations<br>미분방정식 | 3-3-0 | Prerequisite: MTH111 | 1,2 |
| | MTH203 | Applied Linear Algebra<br>응용선형대수 | 3-3-0 | | 1,2 |
| | MTH211 | Statistics<br>통계학 | 3-3-0 | | 1,2 |
| | PHY101<br>(PHY102) | General Physics Ⅰ (General Physics Ⅰ H)<br>일반물리학 Ⅰ (고급일반물리학 Ⅰ) | 3-3-0 | ()is a honor course | 1 |
| | PHY103<br>(PHY104) | General Physics Ⅱ (General Physics Ⅱ H)<br>일반물리학 Ⅱ (고급일반물리학 Ⅱ) | 3-3-0 | ()is a honor course | 2 |
| | PHY105 | General Physics<br>일반물리학 | 3-3-0 | | 1 |
| | PHY107 | General Physics Lab Ⅰ<br>일반물리학실험 Ⅰ | 1-0-2 | | 1 |
| | PHY108 | General Physics Lab Ⅱ<br>일반물리학실험 Ⅱ | 1-0-2 | | 2 |
| | CHM101 | General Chemistry Ⅰ<br>일반화학 Ⅰ | 3-3-0 | | 1 |
| | CHM102 | General Chemistry Ⅱ<br>일반화학 Ⅱ | 3-3-0 | | 2 |
| | CHM103 | General Chemistry<br>일반화학 | 3-3-0 | | 2 |
| | CHM105 | General Chemistry Lab Ⅰ<br>일반화학실험 Ⅰ | 1-0-2 | | 1 |
| | CHM106 | General Chemitry Lab Ⅱ<br>일반화학실험 Ⅱ | 1-0-2 | Prerequisite:<br>CHM101, CHM105 | 2 |
| | BIO101<br>(BIO103) | General Biology (Advanced General Biology)<br>일반생물 (고급일반생물학) | 3-3-0 | () is a honor course | 1,2 |
| IT | ITP107 | Introduction to AI Programming Ⅰ<br>기초 인공지능 프로그래밍 Ⅰ | 3-2-2 | | 1,2 |
| | ITP117 | Introduction to AI Programming Ⅱ<br>기초 인공지능 프로그래밍 Ⅱ | 3-2-2 | | 1,2 |
| MGT | MGT102 | Entrepreneurship & Big Data<br>기업가정신과 빅데이터 | 3-3-0 | | 1,2 |
| | MGT106 | Economics<br>경제원론 | 3-3-0 | | 1 |



### □ Liberal Art

| Category | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ENG | ENG110 | English Listening & Speaking (Intermediate) | 2-2-0 | | 1,2 |
| | ENG111 | English Listening & Speaking (Advanced) | 2-2-0 | | 1,2 |
| | ENG112 | English Reading & Writing | 2-2-0 | | 1.2 |
| LNG[1)] | LNG201 | Chinese Foundation | 2-2-0 | | 1,2 |
| | LNG202 | Chinese Forward | 2-2-0 | | 1,2 |
| | LNG203 | Korean Foundation | 2-2-0 | Only for internationals (substitute for Chinese) | 1,2 |
| | LNG204 | Korean for Everyday | 2-2-0 | | 1,2 |
| | LNG205 | Spanish Foundation | 2-2-0 | | 1,2 |
| AHS | AHS101 | Law and Social Life<br>법과 사회생활 | 3-3-0 | | 1,2 |
| | AHS111 | Arts and Creativity<br>예술과 창의성 | 3-2-1 | | 1,2 |
| | AHS121 | Music and Creativity, Piano<br>음악과 창의성, 피아노 | 3-1-2 | | 1,2 |
| | AHS122 | Music and Creativity, Strings<br>음악과 창의성, 현악 | 3-1-2 | | 1,2 |
| | AHS131 | Literature and Creativity<br>문학과 창의성 | 3-3-0 | | 1,2 |
| | AHS141 | Media and Culture<br>미디어와 문화 | 3-3-0 | | 1,2 |
| | AHS151 | History of Korean Civilization<br>한국문명사 | 3-3-0 | | 1,2 |
| | AHS152 | Evolution of Civilization<br>문명의 발전 | 3-3-0 | | 1,2 |
| | AHS161 | What is I?<br>나의 정체성 | 3-3-0 | | 1,2 |
| | AHS171 | Science of Human Behavior<br>인간행동의 과학 | 3-3-0 | | 1,2 |
| | AHS181 | Discovering Anthropology<br>인류학의 발견 | 3-3-0 | | 1,2 |
| | AHS186 | Understanding Political Science<br>정치학의 이해 | 3-3-0 | | 1,2 |
| | AHS201 | Law and Technology<br>법과 과학기술 | 3-3-0 | | 1,2 |
| | AHS211 | Design Thinking<br>디자인 씽킹 | 3-2-1 | | 1,2 |
| | AHS221 | Advanced Piano<br>피아노 연주 | 3-1-2 | | 1,2 |

| Category | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| | AHS222 | Chamber Music<br>실내악 | 3-1-2 | | 1,2 |
| | AHS231 | The Poetics of the Novel<br>소설의 시학 | 3-3-0 | | 1,2 |
| | AHS241 | Effective Communication<br>효과적 커뮤니케이션 | 3-3-0 | | 1,2 |
| | AHS251 | Histor of Modern Korea<br>한국 근현대사 | 3-3-0 | | 1,2 |
| | AHS252 | History of Contemporary World<br>현대 세계사 | 3-3-0 | | 1,2 |
| | AHS253 | History of Science and Technology<br>과학기술사 | 3-3-0 | | 1,2 |
| | AHS254 | Understanding Korea<br>한국의 이해 | 3-3-0 | | 1,2 |
| | AHS261 | Contemporary Philosophy<br>현대 철학 | 3-3-0 | | 1,2 |
| | AHS271 | Cognitive Science<br>인지 과학 | 3-3-0 | | 1,2 |
| | AHS281 | Society and Culture<br>사회와 문화 | 3-3-0 | | 1,2 |
| | AHS286 | Science and Technology Policy<br>과학기술 정책 | 3-3-0 | | 1,2 |
| **AHS** | AHS291 | Globalization and Economy<br>세계화와 글로벌경제 | 3-3-0 | | 1,2 |
| | AHS301 | Understanding Copyrights and Patents<br>지적 재산권 | 3-3-0 | | - |
| | AHS310 | Topics in Arts<br>예술 특강 | 3-3-0 | | - |
| | AHS311 | Design Management<br>디자인 경영 | 3-3-0 | | 1,2 |
| | AHS320 | Topics in Music<br>음악 특강 | 3-1-2 | | - |
| | AHS321 | Piano Performance<br>피아노 실기 | 3-1-2 | | 1,2 |
| | AHS330 | Topics in Literature<br>문학 특강 | 3-3-0 | | - |
| | AHS331 | Literary Theory<br>문학 이론 | 3-3-0 | | 1,2 |
| | AHS340 | Topics in Communication Studies<br>커뮤니케이션 특강 | 3-3-0 | | - |
| | AHS341 | Human Communication in Information Age<br>정보화 사회의 인간커뮤니케이션 | 3-3-0 | | 1,2 |
| | AHS350 | Topics in History<br>역사 특강 | 3-3-0 | | - |
| | AHS351 | History Through Film<br>영화를 통한 역사 | 3-3-0 | | 1,2 |





| Category | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| | AHS360 | Topics in Philosophy<br>철학 특강 | 3-3-0 | | - |
| | AHS361 | Metaphysical Issues on Persons<br>인간에 관한 형이상학적 문제들 | 3-3-0 | | 1,2 |
| | AHS370 | Topics in Psychology<br>심리학 특강 | 3-3-0 | | - |
| | AHS380 | Topics in Anthropology<br>인류학 특강 | 3-3-0 | | - |
| | AHS381 | Social Science Research Methods<br>사회과학 연구 방법론 | 3-3-0 | | 1,2 |
| | AHS397 | Sports and Health<br>스포츠와 건강 | 1-0-2 | | - |
| | AHS398 | AHS Special Topics Ⅰ<br>AHS 특강 Ⅰ | Variable | | - |
| **AHS** | AHS399 | AHS Special Topics Ⅱ<br>AHS 특강 Ⅱ | Variable | | - |
| | AHS411 | Art, Community, Environment<br>예술, 공동체, 환경 | 3-3-0 | | 1,2 |
| | AHS422 | Violin Seminar<br>바이올린 세미나 | 3-1-2 | | 1,2 |
| | AHS431 | National and World Literature<br>민족문학과 세계문학 | 3-3-0 | | 1,2 |
| | AHS441 | Critical Inquiry for Science and Society<br>과학과 사회의 비판적 탐구 | 3-3-0 | | 1,2 |
| | AHS451 | History, Technoscience, and the Public<br>공적영역과 테크노사이언스 | 3-3-0 | | 1,2 |
| | AHS461 | Philosophy of Science<br>과학철학 | 3-3-0 | | 1,2 |
| | AHS481 | Risk Society and the 21st Century<br>21세기와 위험 사회 | 3-3-0 | | 1,2 |
| | ENG201 | Introduction to English Styles | 3-3-0 | | 1 |
| | ENG202 | English Language & Culture | 3-3-0 | | 2 |
| | ENG203 | English for Business | 3-3-0 | | 1 |
| | ENG204 | English for Science and Technology | 3-3-0 | | 2 |
| **ENG** | ENG205 | Critical Academic Literacy | 3-3-0 | | - |
| | ENG206 | English Language Information and Data | 3-3-0 | | 2 |
| | ENG207 | Global English in Engineering Community | 3-3-0 | | 1 |
| | ENG401 | Writing in Academic Disciplines | 3-3-0 | | |
| | ENG402 | Technical Writing in English | 3-3-0 | | |

1) International students are recommended to take one of Korean courses instead of taking chinese courses.

## 4. Fundamental

### □ Required Mathematics Course

▶ Complete based on 1TR

| School | Track | Course No. | Course Title | Semester |
|---|---|---|---|---|
| Mechanical, Aerospace and Nuclear Engineering | MAE | MTH201 | Applied Linear Algebra | 2-2 |
| | | MTH203 | Differential Equations | 2-1 |
| | NSE | MTH201 | Applied Linear Algebra | 2-2 |
| | | MTH203 | Differential Equations | 2-1 |
| | SDC | MTH201 | Applied Linear Algebra | 2-2 |
| | | MTH203 | Differential Equations | 2-1 |
| Urban and Environmental Engineering | ESE | MTH201 | Differential Equations | 2-1 |
| | | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |
| | UIE | MTH201 | Differential Equations | 2-1 |
| | | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |
| | DME | MTH201 | Differential Equations | 2-1 |
| | | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |
| Design & Human Engineering | ID | MTH203 | Applied Linear Algebra | 2-1 |
| | | MTH211 | Statistics | 2-2 |
| | HFE | MTH203 | Applied Linear Algebra | 2-1 |
| | | MTH211 | Statistics | 2-2 |
| Materials Science and Engineering | AMS | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| | SE | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| Energy and Chemical Engineering | ENE | MTH201 | Applied Linear Algebra | 2-2 |
| | | MTH203 | Differential Equations | 2-1 |
| | ACE | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| Electrical and Computer Engineering | EE | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| | CSE | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| Life Sciences | BIO | MTH203 | Applied Linear Algebra | 2-1 |
| | | MTH211 | Statistics | 2-2 |
| | BME | MTH201 | Differential Equations | 2-2 |
| | | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |
| Natural Science | PHY | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| | CHEM | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| | MTH | MTH201 | Applied Linear Algebra | 2-1 |
| | | MTH203 | Differential Equations | 2-2 |
| Business Administration | MGT | MTH203 | Applied Linear Algebra | 1-2 |
| | | MTH211 | Statistics | 1-2 |
| | FIA | MTH203 | Applied Linear Algebra | 1-2 |
| | | MTH211 | Statistics | 1-2 |
| Management Engineering | MGE | MTH203 | Applied Linear Algebra | 1-2 |
| | | MTH211 | Statistics | 2-1 |

▶ Fundamentals required by another School students when they choose School of Management Engineering track as 2nd track

| Course No. | SME |
|---|---|
| | MGE |
| MTH211 | ✓ |

### □ When student choose tracks from another field

▶ Fundamentals required to Engineering field students when they choose Business field tracks as 2nd track

| Course No. | SBA | | |
|---|---|---|---|
| | MGT | FIA | EPS |
| MGT106 | ✓ | ✓ | ✓ |
| MTH211 | ✓ | ✓ | |

▶ Fundamentals required to Business Administration field students when they choose Engineering field tracks as 2nd track

| Course No. | MANE | | | UEE | | | DHE | | MSE | | ECHE | | ECE | | SLS | | SNS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MAE | NSE | SDC | ESE | UIE | DME | ID | HFE | AMS | MNE | ENE | ACE | EE | CSE | BIO | BME | PHY | CHEM | MTH |
| MTH111 | | | | | | | | | | | ✓ | | | | | | | | |
| MTH112 | ✓ | ✓ | ✓ | | | | | ✓ | | | ✓ | | | | | | ✓ | | ✓ |
| MTH201 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| MTH211 | | | | | | | | | | | | | | | | | | | |
| PHY103 | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | |
| PHY107 | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | | |
| PHY108 | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | | |
| CHM101 | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | |
| CHM102 | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | |
| CHM105 | | | | | | | | | ✓ | ✓ | | ✓ | | | | | | ✓ | |
| CHM106 | | | | | | | | | ✓ | ✓ | | ✓ | | | | | | ✓ | |

※ When business administration field students take "General Physics (PHY105)", it will substitute "General Physics I (PHY101)" as a fundamental course.

※ When business administration field students take "General Chemistry I (CHM101)", they do not need to take "General Chemistry (CHM103)".

▶ Accepted courses to take when changing the field

| Course No. | Course Name |
|---|---|
| Engineering ⇒ Business administration | Calculus I = Calculus[1)] |
| | Business Programming = Engineering Programming I = Introduction to AI Programming I |
| | General Physics I = General Physics |
| | General Chemistry I = General Chemistry |
| Business Administration ⇒ Engineering | Calculus[1)] = Calculus I |
| | Business Programming = Engineering Programming I = Introduction to AI Programming I |

1) 'Calculus' is abolished from 2017 and both BA and engineering field students should take 'Calculus I '.



□ Fundamentals required for Dual Major students (융합복수전공) (Applies to all students)

▶ When students choose dual major in same field: Complete fundamentals based on 1TR

▶ Fundamentals required to Business field students when they choose Engineering field tracks as dual major

| Dual Major | Business Field (1TR) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MANE | | | UEE | | | DHE | | MSE | | ECHE | | ECE | | SLS | | SNS | | | SME |
| Course No. | MAE | NSE | SDC | ESE | UIE | DME | ID | HFE | AMS | MNE | ENE | ACE | EE | CSE | BIO | BME | PHU | CHEM | MTH | MGE |
| MTH112 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| MTH201 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| PHY103 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| PHY107 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| PHY108 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| CHM101 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| CHM102 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| CHM105 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| CHM106 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |

※ When business administration field students take "General Physics (PHY105)", it will substitute "General Physics I (PHY101)" as a fundamental course.

※ When business administration field students take "General Chemistry I (CHM101)", they do not need to take "General Chemistry (CHM103)".

▶ Fundamentals required to Engineering field students when they choose Business field tracks as dual major

| Course No. | SBA | |
|---|---|---|
| | MGT | FIA |
| MTH106 | ✓ | ✓ |
| MTH211 | ✓ | ✓ |

▶ Fundamentals required by another School students when they choose School of Management Engineering track as dual major

| Course No. | SME |
|---|---|
| | MGE |
| MTH211 | ✓ |

## 5. Course Descriptions

### 1) Math & Science

**MTH111 Calculus I [미적분학 I]**

Calculus I is the branch of mathematics dealing with change, rate of change, and motion and it applies in many areas, e.g. engineering, the physical sciences, and the biological sciences. We will investigate the concepts of differentiation and integration of real-valued functions of single variables and their applications. The topics include trigonometrics, logarithmics, hyperbolic functions and their inverse functions, limits, sequence, series and convergence as well as differentiation and integration.

**MTH112 Calculus II [미적분학 II]**

Beyond basic calculus we study differentiation and integration of vector-valued functions of multi-variables and their applications. The topics include vector functions, partial derivatives, multiple integrals and vector calculus.

**MTH114 Advanced Calculus [고급미적분학]**

It is an advanced/honors calculus course designed for students who have a good record of performance in mathematics. This course is intended to provide mathematically curious students who are ready to work hard, mathematically stimulating subjects not only from Calculus but also from advanced mathematical discipline such as Analysis, Algebra, Geometry, and Topology.

**MTH201 Differential Equations [미분방정식]**

This course studies ordinary differential equations and their existence and uniqueness, and methods for their solution, including series methods and Laplace transforms, systems of differential equations and their solvability, stability, and numerical methods.

**MTH203 Applied Linear Algebra [응용선형대수]**

This course studies solving systems of linear equations, matrix algebra, linear transformations, determinants, rank, vector spaces, eigenvalues and eigenvectors and diagonalization.

**MTH211 Statistics [통계학]**

This course introduces the concepts of probability and distribution, expectation, distributions of functions of random variables, statistical inference, estimation, and statistical tests.

**PHY101 General Physics I [일반물리학 I]**

Physics I is the first half of a one-year introductory university physics course intended for students who plan to major in the fields of science and engineering. It introduces the fundamental concepts and analytical descriptions of classical mechanics, wave mechanics, and thermodynamics. Topics covered include measurement basics of physical quantities, vectors, translational motions in one, two, and three dimensions, force, conservation laws of energy and momentum, rotational motion, gravitation, fluid mechanics, description of waves, kinetics of gases, and thermodynamic laws. Knowledge of calculus is routinely used but the emphasis is placed on understanding basic concepts. E-educational system will be actively used in conjunction with class lectures.

**PHY102 General Physics I H [고급일반물리학 I]**

Students, who take this course will learn in-depth physics and will experience a new world of physics. It covers the same contents as General Physics I.

**PHY103 General Physics II [일반물리학 II]**

Physics II is the second half of a one-year introductory university physics course intended for students who plan to major in the fields of science and engineering. It introduces the fundamental concepts and analytical descriptions of electricity, magnetism, optics, and also modern physics based on quantum physics. Topics covered include electric forces and fields, electric energy, capacitance and resistance, circuits, magnetic forces and fields, induction, electromagnetic waves, reflection and refraction of light, wave optics, atomic physics, electrical conduction of solids, and subatomic (nuclear, elementary particles) physics. Knowledge of calculus is routinely used but the emphasis is placed on understanding basic concepts. An E-education system will be actively used in conjunction with class lectures.

**PHY104 General Physics II H [고급일반물리학 II]**

Students, who take this course will learn in-depth physics and will experience a new world of physics. It covers the same contents as General Physics II.

**PHY105 General Physics [일반물리학]**

Physics is a one-semester introductory university physics course intended for students planning to major in technology management. This course focuses on providing students with the fundamental ideas of general physics area to help them understand modern technology from a technology management perspective. Hence the majority of course is devoted to discussing the basic principles and concepts of physics although knowledge of calculus is assumed. Topics covered will be selected from classical mechanics, thermodynamics, electricity and magnetism, optics, and modern physics. The E-educational system will be actively used in conjunction with class lectures.

**PHY107 General Physics Lab I [일반물리학실험 I ],**
**PHY108 General Physics Lab II [일반물리학실험 II ]**

This laboratory has been designed to assist students in the General Physics I & II. Laboratory work constitutes an essential part of all physics courses. This lab does not only give an opportunity to the engineering students to establish a bridge between the theoretical concept that they learn in classroom and

the real physics experiments, but also helps them to improve their application skills. Experiments in this lab have been specifically designed to cover the fundamental aspects of General Physics I & II. General Physics I lab covers nine mechanical experiments and General Physics II lab covers nine experiments of electricity and magnetism.

### CHM101 General Chemistry I [일반화학 I]

This course presents the concepts and models of chemistry. Topics include atomic and molecular structure, nomenclature, chemical reaction and stoichiometry, atomic structure and periodicity, chemical bonding, physical and chemical equilibrium, and thermochemistry. This course is designed for students who plan to major in science and engineering.

### CHM102 General Chemistry II [일반화학 II]

As the continuation of General Chemistry I, this course includes acid and base, chemical kinetics, electrochemistry, transition metal chemistry, nuclear chemistry, and organic chemistry. This course is designed for students who plan to major in science and engineering.

### CHM103 General Chemistry [일반화학]

This course presents chemistry conceptually, focusing on the study of how atoms combine to form materials, on what materials are made of, and why they behave as they do. This course is designed for students who plan to major in the business administration.

### CHM105 General Chemistry Lab I [일반화학실험 I ]

This course is designed to demonstrate fundamental principles of general chemistry in a laboratory environment. This laboratory and its experiments help students understand the underlying concepts, experimentation and of laboratory instruments and techniques. It will be an effective way to make chemistry more fun.

### CHM106 General Chemistry Lab II [일반화학실험 II ]

This course is a continuation of CHM105 with emphasis upon solution properties, kinetics, equilibrium, acids and bases, and quantitative analysis.

### BIO101 General Biology [일반 생물]

This is a one-semester course dealing with the principles and concepts of biology needed for success in higher level science courses. Topics include the organization of living matter, cell structure, enzymes, metabolism, energy transformation, reproduction, genetics, and DNA technology. Each class will consist of two lectures per week.

### BIO103 Advanced General Biology [고급일반생물학]

This course introduces diverse biological research topics conducted in UNIST. Freshmen who want to learn more detail about biology are encouraged to attend. This course will be helpful for choosing laboratories for internship as well as graduate study in UNIST.



## 2) Management

### MGT102 Entrepreneurship & Big Data [기업가정신과 빅데이터]

This course provide a broad-based introduction to entrepreneurship and big data analysis for all UNIST students. It consists of two parts: (1) Entrepreneurship and (2) Big data.
The Entrepreneurship part is intended to be an introduction to the business world for students who aspire to become entrepreneurs or leaders, whether launching new ventures directly from school or aspiring to lead an organization later in their careers. Knowledge and insights gained from this course help students develop deeper understanding of the mindset, leadership, and attributes of successful entrepreneurs. Furthermore, by examining their entrepreneurial processes, students will be able to shape and define their core values, personal philosophies, leadership, as well as understand and identify opportunities to create something new and better for the world. It is a “think about it” course in which students learn entrepreneurship and get the feel for what management in the real world is about. Upon successful completion of the course, every student is expected to be charged with enthusiasm for the study at the UNIST, excitement for the business world, and confidence for his/her professional career in the future. The Big data part provides an introduction to data science and analytics especially focusing on the new trend of big data analytics and their applications. Big data is becoming a growing necessity within managers for better decisions to understand better various phenomenon in business. To obtain opportunity to realize enormous gains in terms of efficiency, productivity, revenue, profitability and better decision, big data is becoming less of a competitive advantage and more like an industry standard. This course explores cutting-edge companies supporting an exciting new generation of business analytics. This course aims to demonstrate how the winners of the future will use big data to seek the truth, and to guide on how to win customers, beat competitors, and boost the bottom line with big data. Through this part, students learn to explain what big data is, and how it will transform the enterprise; learn more about the trends in big data and how managers use them effectively to make critical decision; read and discuss case studies of big data use in big companies; discuss real-world examples from a variety of organizations leveraging big data; explore how to link big data initiatives in organization’s value creation process; explore values surrounding operationalizing big data in organization, including educational challenges.

### MGT106 Economics [경제원론]

This course aims to provide a basic understanding of Economics. This course provides an introduction to the analysis of the principles underlying the behavior of individual consumers and business firms. Topics include problems of international trade, distribution of incom, problems of environmental pollutions, and effects of various market structures on economic activity.

### 3) IT

**ITP107 Introduction to Artificial Intelligence Programming I [기초 인공지능 프로그래밍 I]**

This course aims to introduce fundamental concepts and methodologies of computer programming in Python which will lead to develop basic components of artificial intelligence systems and applications. Students will learn basic programming skills such as using programming syntax, making a logical decision, and looping a logic as well as introductory computer algorithms such as data sort and search from on/offline lectures. Students will also gain hands-on programming experiences with artificial intelligence examples.

**ITP117 Introduction to Artificial Intelligence Programming II [기초 인공지능 프로그래밍 II]**

This course aims to teach basic problem solving skills using Python and deliver an experience to develop foundational artificial intelligence applications and systems using a deep learning tool. This course also aims to teach how to use hardware platforms such as Raspberry-Pi and Jetson to develop artificial intelligence applications. With the tools provided, students will gain hardware control experiences such as controlling cameras, displays, and motors as well as gain programming experiences on artificial intelligence such as image classification with MNIST and CIFAR-10 datasets and music generation.

### 4) English

**ENG110 English Listening & speaking [Intermediate]**

This course is a practice of English speaking at the intermediate level. The students are expected to develop English listening and speaking proficiency required to handle successfully uncomplicated tasks and social situations requiring an exchange of basic information related to their work, school, and particular interests. The course will provide interactive speaking activities to address these goals.

**ENG111 English Listening & speaking [Advanced]**

This course is a practice of English speaking at the advanced level. The students are expected to develop fluency and accuracy in English listening and speaking by learning through on-line materials and participating in classroom activities.

**ENG112 English Reading & Writing**

This course is a practice of English reading and writing along with building grammatical competence necessary for students' success in an academic field. The students will actively participate in on-line and in-class practices of English papers, essays, and correspondence.



### 5) Foreign Languages

**LNG201 Chinese Foundation**

Chinese Foundation is intended for the students who have never studied Chinese language before. The objectives of this course are to enable the students to master some basic knowledge about Chinese language (phonetics, grammar structures, characters etc.) and gain the ability to use the knowledge in simple conversations.

**LNG202 Chinese Forward**

Chinese Forward is intended for the students who have learned Chinese language for one semester before. The objective of this course is to improve students' ability to use Chinese, including listening, speaking, reading and writing. This course will be accomplished through the use of board and in class practices. Students will have the chance to make simple conversations about their daily lives with other students and the instructor as well as write some easy essays.

**LNG203 Korean Foundation**

The aim of this class is developing abilities of non-native speakers. In the beginner level 1 the aim is that of fundamental communication in Korean, beginning with learning vowels and consonants, self-introductions, shopping, express of numbers, phone numbers, dates and prices, ask and give for direction, talking about your friend's schedule etc. Vocabulary related to time and location and students can also make sentences by themselves using basic verbs. Also, students will understand and express themselves in every day life situations.

**LNG204 Korean for Everyday**

The purpose of the lecture is to improve Korean language ability of learners who are educated Korean language for more than 75 hours or has Korean language ability corresponding to the above. The lecture will make learners perform basic language functions required to daily life such as expressing a plan, ability, symptoms, describing, asking opinions, making suggestions, promising and expressing experience.

**LNG205 Spanish Foundation**

Spanish Foundation is intended for the students who have never studied Spanish language before. The objectives of this course are to enable the students to master some basic knowledge about Spanish language (phonetics, grammar structures, characters etc.) and gain the ability to use the knowledge in simple conversations.

## 6) AHS

### AHS 101 Law and Social Life [법과 사회생활]

This course explores a range of legal disciplines which purport to explain how we are governed globally and which propose projects for improving global governance through law. We will focus on the field of international law and organization, examining the history of ideas, legal doctrines, institutional and administrative structures developed over the last century to organize and legalize international economic and political life.

### AHS111 Arts and Creativity [예술과 창의성]

This course introduces students to the use of arts and design to develop fresh approaches to creating new content in the arts, humanities, and technologies. Students explore diverse themes and topics in the contemporary arts, digital humanities, and product prototyping to create novel media objects or compositions through teamwork. Readings include a selection of classic and contemporary critical cultural texts from the arts and design.

### AHS121 Music and Creativity, Piano [음악과 창의성, 피아노]

This course encourages students to develop creativity and excellence in the study of music through piano performance. The first few classes will be devoted to the history of Western classical music, and the rest will focus on the performance of piano music. Students will have an opportunity of performing both solo piano literature and ensemble piano music with proper musical technique. Students will also be able to develop good communicative skills through the process of making music together to arrive at interpretive and creative conclusions for an end-of-semester concert performance.

### AHS122 Music and Creativity, Strings [음악과 창의성, 현악]

This course encourages students to develop creativity and excellence in the study of music through string performance. During the first three weeks of class, history of Western music will be introduced. The rest of the semester will focus on exploring string instruments of choice. Students will have an opportunity of performing string quartet literature with proper instrumental technique and creative musicianship. Students will also be able to develop good communicative skills through chamber music performance, and learn the value of teamwork. The concert that is held at the end of the semester, will give students the opportunity to perform in front of a large audience, allowing them to take a glimpse of the life of string quartet performers.

### AHS131 Literature and Creativity [문학과 창의성]

To understand literary genres, which are the formal structure of literature, this course aims to develop critical thinking and basic skills of analysis. For this aim, it surveys poetry, fiction, drama, and the literary essay (including a travelogue, a diary, and reportage). While comprehending individual works on the basis of their stylistic traits, students are expected to learn literary terms and build their own aesthetic judgment through group discussions and guided discussions with the instructor. This course is particularly designed for freshmen who have been rarely exposed to various forms in literature.



### AHS141 Media and Culture [미디어와 문화]

This course aims to introduce you to a topic ranging from human interaction, TV, film, and sound to communicative consequences of globalization, and to provide you with a way of thinking about fundamental concepts that you will find in other areas of communication studies and further applyin an interdisciplinary field. Fundamental concepts discussed in the course will facilitate a new way of thinking and learning knowledge and skills that constitute moral and ethical views on our lives.

### AHS151 History of Korean Civilization [한국문명사]

This course traces the emergence of a distinctive civilization on the Korean peninsula in Northeast Asia from prehistory to the modern day. It looks at the emergence of both Korean culture and a Korean state and then turns to how Korea managed to maintain its cultural and political autonomy over the centuries. It examines social and cultural changes, the status of women, the rise of ideologies such as nationalism, communism, and democracy, and the transformation of the religious landscape of Korea.

### AHS152 Evolution of Civilization [문명의 발전]

This course is designed to chronologically explore the major events, issues, and debates that have shaped the world from the birth of civilization to the present. While focusing on the West, the course also pays attention to how the West interacted with the rest of the world. Students will be guided to consider how politics and economy shaped society and culture.

### AHS161 What is I? [나의 정체성]

In this course we shall examine various philosophical views at the preliminary level. The aim of the course is to provide the students with a general introduction to seminal questions in philosophy, to lead them to engage in deep thinking and reflections on important matters in life, and to enable them to make their own arguments on a given issue in a critical and reasonable fashion.

### AHS171 Science of Human Behavior [인간행동의 과학]

This course explores the introductory in psychology, such as perception, learning, memory, sleep and mental illness. There will be an overview of history of psychology, cognitive psychology, evolutionary psychology, social psychology, developmental psychology, educational psychology, clinical psychology, counseling psychology, and so forth.

### AHS181 Discovering Anthropology [인류학의 발견]

The course introduces a cultural perspective on human behavior based on anthropology, the comparative study of cultures. The concepts and terms for social scientific study of culture are introduced through the presentation of case studies from diverse cultures, through the viewing of ethnographic films and other materials. Topics covered include social structure, social institutions, family and kinship, economic organization, politics and ritual behavior. In addition to ethnography, archaeology and linguistics are included for their contributions to anthropology.

### AHS 186 Understanding Political Science [정치학의 이해]

This course introduces the key concepts, theories, methods and issues of political science, divided into three subfields of political theory, comparative politics, and international relations. While political theory provides students with a solid understanding of the concepts underpinning the discipline, comparative politics introduces the analysis of political institutions, processes, and outcomes at the national level. Finally, international relations will introduce students to the increasing importance of supranational institutions and actors. Major case studies from Korea, the USA, Europe and other regions may be presented.

### AHS 201 Law and Technology [법과 과학기술]

An introduction to and exploration ofthe intersection of science and the law, focusing on the intellectual property system and the various means by which the conduct and products of scientific research are regulated. The course will analyze and compare American, international, and theoretical alternative systems. The course will also explore particular scientific areas in depth (Possible examples could include the human genome project; the Internet and cyberspace; cloning; the law of the sea; international cooperation on Antarctica; and outer-space exploration).

### AHS211 Design Thinking [디자인 씽킹]

Using the design process and DBL (Design-Based Learning) we solve the problem in visual ways under the double diamond methodology which is spreaded from D. SCHOOL at Stanford University to use Design Thinking to work on multiple real world challenges in a diverse team. Tenets of design thinking including being human-centered, prototype-driven, and mindful of process. Topics include design processes, innovation methodologies, human factors, visualization, rapid prototyping, team dynamics, storytelling, and project leadership. It is more for collaborative and multidisciplinary project activity that make students familiar with basic perceptual concepts as well as two-dimensional and three-dimensional visual concepts. It moves into a more sophisticated problem-solving environment in which structure, organization, composition, proportion, scale will be emphasized.

### AHS221 Advanced Piano [피아노 연주]

This course is reserved for students who already have fundamental knowledge and experience of piano playing. Students will further develop and refine their piano technique through performing advanced piano repertoire and technical exercises. Since the course deals with difficult piano pieces in different styles, extensive practice outside of class will be required.

### AHS222 Chamber Music [실내악]

This course is reserved for students who already have fundamental knowledge and experience of string playing, or for students who have taken AHS 122. Students will further develop their instrumental skills through exploring advanced string chamber music repertoire.



### AHS231 A Poetics of the Novel [소설의 시학]

This course aims to examine the genre of novel by looking into various aspects such as plot, point of view, characters, figurative language, motif, etc. A critical attention will also be paid to the context surrounding the work of a novel. Given the popularity and dominance of novel in contemporary literature, a close reading of a novel or two in this course will help students comprehend the genre and narrative in general. A group discussion based on in-depth analysis of the literary work will be the core of classroom activities and students will be expected to develop independent and critical thinking.

### AHS241 Effective Communication [효과적 커뮤니케이션]

In this course, we'll learn about rhetoric as fundamental concepts and skills for communication. This will involve considering how communication is produced, in what way its meanings are shared in particular contexts, and how engaging in certain texts and meanings shapes various effective communicative forms of public life.

### AHS251 History of Modern Korea [한국 근현대사]

This course covers the contemporary Korean history after the Korean War (1950-1953). With the emphasis on the aftermath of the Cold War, the development of the democratization movement, the progression of nationalism, the success of industrialization, and the transnational movement of Korean pop culture (Hallyu 韓流), the class will examine such crucial topics of our days as nationalism, civil society, social/technology, gender, regionalism, historiography, religion, and popular culture.

### AHS252 History of Contemporary World [현대 세계사]

This course is designed to thematically explore how modern world has been shaped. Taking global perspective, it traces the flow of people, idea, culture, money, and technology in the 20th century. The goal of this course is to help you better understand our current world.

### AHS253 History of Science and Technology [과학기술사]

Science and technology have produced both benefits and risks since the beginning of human civilization. This course encourages students to critically examine how historical, cultural and political contexts have influenced the developmental pathways of science/technology and vice versa. Students will analyze how public perception of science/technology has been constructed within specific social, political and local circumstances. Our ultimate goal is challenging: we aim to devise a new system where the public can trust science/technology and science/technology can meet with the public's practical concerns in current society.

### AHS254 Understanding Korea [한국의 이해]

Korea is often known as "the hermit kingdom" or "the land of morning calm" to Westerners. Contrary to the static and even passive images in such expressions, Korea has gone through swift changes internally and externally. As an introduction of Korea particularly designed for UNIST's international students, this course aims to examine various issues regarding what makes the current shape of Korea by dealing with specific

topics in society, culture, history, literature, and others. In order to keep an academic depth while covering the topics comprehensively, instructors in the Division of General Studies will take turns to teach individually or collaboratively. Course materials are English translations and class discussion will also be conducted in English.

### AHS261 Contemporary Philosophy [현대 철학]
This course deals with the central issues of contemporary philosophy. We will discuss in depth at least one of the main branches in philosophy such as metaphysics, logic, ethics, philosophy of science, and philosophy of mind. Since the issues covered in contemporary philosophy are diverse, the specific contents of the course may vary. There are no prerequisites for this course.

### AHS 271 Cognitive Science [인지 과학]
Cognitive science is the interdisciplinary scientific study of the mind and its processes. It examines what cognition is, what it does and how it works. It includes research on intelligence and behaviour, especially focusing on how information is represented, processed, and transformed (in faculties such as perception, language, memory, attention, reasoning, and emotion) within nervous systems (humans or other animals) and machines (e.g. computers). Cognitive science consists of multiple research disciplines, including psychology, artificial intelligence, philosophy, neuroscience, linguistics, and anthropology.

### AHS281 Society and Culture [사회와 문화]
This course aims to provide students with a solid understanding of society and culture by examining various social and economic institutions, processes, and issues. The course will specifically focus on topics and issues that figure prominently in social trends and patterns of change; the issues may include gender roles, family, education, identity, environmental issues and globalization. Each of these issues will be examined through anthropological, sociological, comparative or/and historical perspectives.

### AHS 286 Science and Technology Policy [과학 기술 정책]
Science and technology policy is very important since if fulfills the two functions of boosting research and development (R&D) and linking it with the industrial sector. In this class, students are expected to understand the government's role in framing and carrying out the policy, and they should know the characteristics of Korea’s national innovation system. Students will be able to understand current situation of Korea by understanding the changes that were made during the last half of 20th century. Students will also discuss the future pathways for furthering science and technology policy development in Korea.

### AHS291 Globalization and Economy [세계화와 글로벌경제]
This course focuses on what constitute the key economic issues that feature in the debate over economic globalization and what challenges each issue faces. We will start discussing the key economic issues from the 5th week to the final (15th) week. Especially, you will team up with other classmates and each team will prepare for in-class presentation and present for the 12th to the final (15th) weeks on one of the key economic issues covered in class. In addition, this course, to make students better grasp the key economic issues and their challenges that stem from the process of economic globalization, will provide students with lectures on the introductory and core principles of economics (microeconomics) which will be covered in class over the 1st to the 4th (or 5th ) weeks.

### AHS301 Understanding Copyrights and Patents [지적 재산권]
This course introduces the intellectual property rights protected by copyright law with particular attention to issues of Cyberlaw (e.g., software and digital copying), Entertainment Law (e.g., music industry), and Communications Law (e.g., cable-related issues). International aspects will be considered as well. In addition, the course introduces the history and structure of the patent system, focusing on what patents are and how they function.  Students will also learn the requirements for obtaining a patent. Patent enforcement is explained in relation to the issues of infringement, defenses to infringement, and remedies.

### AHS310 Topics in Arts [예술 특강]
This course focuses on a special topic in the field of Arts. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS311 Design Management [디자인 경영]
Design Branding, Design Administration, Design Management will be dealt with their core concept and importance in company. Marketing and consumer psychology discussion will be followed defining a design process, analyzing typical steps, fragmentation of market and selection of target market in design process. Using the design process and DBL (Design-Based Learning) we solve the problem in visual ways under the double diamond methodology which is in seed from D. SCHOOL at Stanford University.

### AHS320 Topics in Music [음악 특강]
This course focuses on a special topic in the field of music. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS321 Piano Performance [피아노 실기]
This course offers a directed program of study that includes intensive piano lessons and a survey of the piano literature. The course mainly focuses on developing technique and artistry through studying and performing piano repertoire. Students will learn how to understand the music better through discussion of stylistic, historical, and formal aspects of piano literature. The course will also focus on developing fundamental keyboard skills in sight-reading, technique and aural skills. Material covered in this course is individually determined by the instructor.

### AHS330 Topics in Literature [문학 특강]
This course focuses on a special topic in the field of literature. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS331 Literary Theory [문학이론]
This course is designed to introduce those who minor in AHS to some important literary theories, a central component of world literature. This introductory course is organized around Western literary texts that allow theoretical interpretations developed in the twentieth century from Russian formalism to post-colonialism. Students will gain knowledge of the methods with which literary critics construe and analyze literature. A close attention will be paid to issues pertaining to cultural value and colonial biases of Western and/or Asian literature.

### AHS340 Topics in Communicate Studies [커뮤니케이션 특강]
This course focuses on a special topic in the field of communication. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS341 Human Communication in Information Age [정보화사회의 인간커뮤니케이션]
In order to cope with the uncertain future that technology is changing, various literacy and communication skills are increasingly important. This course examines the study and theories of human communication including intrapersonal, interpersonal, and group communication. Topics include communication and features in post-information age, literacy in AI era, intrapersonal communication (needs and personality, cognitive processing, self-identity, emotion etc.), interpersonal communication (listening, self-exposure, non-verbals, etc.) and group communication (conflict resolution, facilitation techniques). This course takes an experiential approach to the study of the process of communication at the intrapersonal, the interpersonal, and group levels.

### AHS350 Topics in History [역사 특강]
This course focuses on a special topic in the field of history. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS351 History Through Film [영화를 통한 역사]
This course explores how history has been represented in the movies. It investigates the different varieties of representation—costumes dramas, works of “faction” (fact plus fiction), and so-called historical films—and investigates the differences between them. We will focus on accessible major Hollywood films, with a few international films included, and on narrative film rather than documentaries. We will investigate what a historical work is, what types of historical works exist, and whether or not fictional films can be historical works. If they can be, what are their strengths and weaknesses compared to other historical sources?

### AHS360 Topics in Philosophy [철학 특강]
This course focuses on a special topic in the field of philosophy. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS361 Metaphysical Issues on Persons [인간에 관한 형이상학적 문제들]
In this course we shall examine various philosophical issues on personhood such as personal identity, free will, and mortality. There are perennial metaphysical questions on the nature of a person. What makes me one and the same person as me existing at different times? Does the biological death mean the end of our career? How do metaphysical and ethical issues on death pertain to our nature as persons? Are we a kind of being who enjoy free agency? Is free will compatible with determinism? While engaging in deep philosophical questions, students will learn how to be creative and reflective in developing their own thoughts.

### AHS370 Topics in Psychology [심리학 특강]
This course focuses on a special topic in the field of psychology. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS380 Topics in Anthropology [인류학 특강]
This course focuses on a special topic in the field of anthropology. The particular contents of this course will be chosen by the instructor each semester when it is offered.

### AHS381 Social Science Research Methods [사회과학 연구 방법론]
This course aims to provide students with a solid understanding of research methods for the study of society and culture. The research methods most widely used in the social sciences are: qualitative (descriptive) and quantitative (statistical). Ethnography is a qualitative method that focuses on how people interact with each other, and explores the knowledge, beliefs and norms of groups of people who interact on a regular basis. In this class, students will learn ethnographic methods to do research. Students will learn how to form research questions, make a proposal, collect data and write a short research paper.

### AHS397 Sports and Health [스포츠와 건강]
The course provides instruction in fitness activities for the development of physical and mental health.

### AHS398 AHS Special Topics Ⅰ[AHS 특강 Ⅰ]
This course focuses on a special topic in any field of AHS.

### AHS399 AHS Special Topics Ⅱ [AHS 특강 Ⅱ]
This course focuses on a special topic in any field of AHS.

### AHS411 Art, Community, Environment [예술, 공동체, 환경]
This course provides a venue for students to explore the relationship among environment, community and art. Students will consider the sociocultural meanings of contemporary visual art practices by reviewing a wide range of place-based activities developing in the fields of ecological art, community art, and interdisciplinary environmental art. To achieve comprehensive and interdisciplinary project-based inquiry, students will review philosophical and socio-historical discussions on community art projects, environmental art projects, and diverse forms of art practice experiments in the ecological realm.

### AHS422 Violin Seminar [바이올린 세미나]

This course is designed to offer individualized instruction for violinists with diverse musical backgrounds. In this course, a wide range of topics will be covered from basic techniques such as scales and etudes to standard repertoire from the violin literature. An intensive course aiming to cultivate proficiency on the violin, this course focuses on developing technique and artistry through stylistic, historical, and formal aspects through various violin repertoire. Instruction also includes preparation for the student's end of the semester performance, and studio classes which will provide smaller performance opportunities along with a constructive atmosphere to give and receive feedback from their peers. A student's level determines his or her assigned course schedule.

### AHS431 National and World Literature [민족문학과 세계문학]

This course aims to explore the status and meaning of national literature in the theory and practice of world literature. For this objective, it will look into national literature's social and historical interactions, which produced such a world-scale perspective in the age of globalization. Topics include colonialism, post-colonialism, world-system theory, distant reading, and more. With a basic understanding of each school's theoretical underpinnings, we will closely re-read literary works from different countries, including Korea, and question the canonization and institutionalization of literature.

### AHS441 Critical Inquiry for Science and Society [과학과 사회의 비판적 탐구]

Drawing on "rhetoric of Inquiry," a name for the qualitative method of exploring and applying scientific, religious, political, and cultural dimensions of human interaction, the course aims: 1) To elaborate on some of rhetorical and literary devices in examining persistent or emergent ideas and topics such as surveillance, security, health, trauma, fMRI, fact, post-truth, human rights, justice, market, psychological warfare, etc. 2) To develop the sophisticated understanding of what novel connections between discourses in scholarly debates, global public health, educational policy, etc. are (or can be) made. 3) To demonstrate interdisciplinary competence and problem-solving skills in complex scientific, political, or social questions.

### AHS451 History, Technoscience, and the Public [공적영역과 테크노사이언스]

This course will survey historical and sociological literature on the changing relationship between science/ technology and the public. We attempt to form better understanding of so-called 'ethical concerns' not as individualized emotional concerns over science-related risks but as an emergent from power relations between the public and the prevailing institutional scientific/technological culture. In this course students will learn 1) history of the relationship between science/ technology and the public, 2) history of the public imagination of science/ technology (associated with hopes, fears, norms, desires, and self-identities, 3) history of the public policy as an ever changing arena.

### AHS461 Philosophy of Science [과학철학]

This course aims to shed light on the nature of science. We raise and answer such questions as the following. How does science understand an object? What is the structure of a scientific theory? What are the characteristics of scientific explanations? How is a scientific theory related to observations? How does science develop? Is a scientific revolution a rational or irrational affair? On what basis do scientists choose a theory over its competitors? Are our best current scientific theories are true? How do we differentiate between science and religion?

### AHS481 Risk Society and the 21st Century [21세기와 위험 사회]

This course examines the concept of "risk" as used by researchers in the social sciences, particularly in the fields of anthropology, sociology, STS and social psychology. The course will look at how risk is produced in social institutions that shape collective behavior. Institutions to be considered include food production, energy production, transportation, financial regulation, politics and conflict resolution, climate change adaptation and medical/health systems. The focus will be on case studies and theoretical perspectives for students to apply to their own research topic of interest.

### ENG201 Instruction to English Styles

This course is an introduction to various English styles. Through reading and listening to varieties of English (informal and formal English; newspaper; correspondence; stories etc.), students will understand appropriate uses of English styles to different time and place.

### ENG202 English Language and Culture

This course introduces the crucial relationship between English language and culture. Students are expected to learn how to manage different communicative tasks appropriately to the cultural and contextual constraints. Through reading and listening to various texts/episodes of English, students will practice how to handle communicative problems in terms of culture.

### ENG203 English for Business

This course will help the students understand practical English in a business situation. Students will learn and practice how to function in business-related contexts in English appropriately and effectively.

### ENG204 English for Science and Technology

The course is designed to engage students in English for science and technology. To this end, the course offers situation-based listening and speaking activities, content-based reading exercises, and scientific research writing practices. At the end of this course, students will be able to achieve necessary English proficiency as scientists.

### ENG205 Critical Academic Literacy

The course is designed to develop students' academic reading and writing processes. Toward this end, the course covers the nature of academic writing, critical thinking and argumentation, while students engage in academic content area reading followed by in-depth discussion. At the end of this course, students will be able to critically evaluate and read academic contents, and re-synthesize the contents.

### ENG206 English Language, Information, and Data

"English Language, Information, and Data" introduces and discusses the theory of language underlying the large-scale collection of texts designed for research purposes, To this end, the course focuses on the principles of the theory and practice of the corpus linguistic approach to language with computerized text analysis programs. Specifically, the statistical quantitative analysis of language and the quantitative analysis of semantic prosody are discussed to account for understanding human cognition, interaction, behaviour and discourses. The course also discusses the application of analysis results in the diverse areas of scientific disciplines.

### ENG207 Global English in Engineering Community

Global English in Engineering Community is designed to help engineering students develop strategies to achieve interactional goals, either in speaking or writing, when English is used with speakers with other cultures. The course emphasizes acquisition of some of the interaction strategies that will promote proper relations in the globalized world, e.g., ways to communicate engineering topics, establish rapport, and further minimize cultural differences. Further, the course accommodates to textual competence of English used as an international language in an engineering community.

### ENG401 Writing in Academic Disciplines

The course is designed to help entry level graduate students expand their knowledge of scientific English in the relevant fields and develop the essential communication skills needed in the specific contexts. The major aim of the course, therefore, is to build up students' confidence in using English in a variety of academic settings of scientific community. To this end, the course consists of student presentations, workshops, lectures and discussions involving various types of scientific writing.

### ENG402 Technical Writing in English

This course is designed to help graduate students in engineering and science with their course-specific writing tasks. You will find the course most productive if you are already engaged in a research project; you can then use your own data in the course assignments. As the author of your own paper, you will be responsible for leading group discussions and for explaining assigned readings.





# School of Mechanical, Aerospace and Nuclear Engineering

## 1. School Introduction

The School of Mechanical, Aerospace and Nuclear Engineering (SMANE) consists of three tracks such as Mechanical and Aerospace Engineering (MAE), Nuclear Science and Engineering (NSE) and System Design and Control Engineering (SDC). The SMNE focuses on world-class research and education in order to nurture creative experts and scholars who can contribute to the development and advancement of cutting-edge industries. Interdisciplinary approaches with the state-of-the-art facilities by concentrating on a variety of research fields, including design, manufacturing, thermofluid engineering, system control, robotics, system analysis, unmanned vehicles, aerospace engineering, energy, nuclear reactions, nuclear fuels and nuclear fuel cycle, nuclear fuel cladding and structural materials, nuclear reactor/system, and many nuclear applications. Although the SMANE provides two disciplines with students it together emphasizes the creativity and ingenuity of the education.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Mechanical and Aerospace Engineering (MAE)

Mechanical and Aerospace Engineering deals with numerous systems and has a variety of important applications such as automobiles, aircraft, ships, home appliances, electronic devices, power plants and so on. The mechanical systems and the fundamental science and technology of mechanical and aerospace engineering have made dramatic advances and high impacts on the global economies and the standard of living. In the track of mechanical and aerospace engineering, students are educated and trained to learn the underlying principles of mechanical and aerospace engineering and to apply the knowledge to real-world examples and case studies hands-on. Disciplines include thermodynamics, fluid mechanics, solid mechanics, dynamics, machine design, advanced materials processing, laser-assisted manufacturing, micro/nano machining, unmanned vehicle control, MEMS, biomedical products, controls and mechatronics, acoustics, tribology and so on.

### 2) Nuclear Science and Engineering (NSE)

Nuclear Science and Engineering is comprised of various science and engineering branches, such as nuclear reactor physics, radiation engineering, nuclear safety engineering, thermohydraulics, nuclear materials engineering, radiation material science, nuclear fuel cycle engineering, health physics, nuclear policy, nuclear material safeguards and non-proliferation, nuclear power plant decontamination and decommissioning, and nuclear fusion science and engineering. The Track of Nuclear Science and Engineering currently has 10 faculty members and provides a variety of courses covering almost all the branches of nuclear science and engineering abovementioned. The thoroughness of our program will promote students to be fully qualified nuclear scientists and engineers who can compete globally.

### 3) System Design and Control Engineering (SDC)

System Design and Control Engineering focuses on; (i) rehabilitation robotics (ii) additive manufacturing & simulation (iii) smart factory control, and (iv) machine healthcare. The objective of this track is to provide a course of study that will enable the student: (i) to complement his/her viewpoint of the design activity from sketching to the logical engineering process of creating something new, or modifying/rearranging something that pre-exists for improvement, and thus (ii) to think not only creatively, but also systematically for the design of products, processes or other systems. The track provides the student with essential engineering design knowledge and tools to begin a productive professional career in industry or academia. Furthermore, the track teaches the student how to plan and manage the entire product development process. This will prepare the student to succeed not merely as an engineering designer but also as a design manager who is capable of driving the new product development projects.

## □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| MAE | Required | 33 | 9[1)] | |
| | Elective | 21 | 9[2)] | |
| NSE | Required | 33 | 3[3)] | |
| | Elective | 21 | 15 | |
| SDC | Required | 24 | - | |
| | Elective | 30 | 18 | |

1) Students who choose MAE as their 2nd track are required to take at least three out of eight courses: Thermodynamics, Fluid mechanics, Solid Mechanics Ⅰ, Solid Mechanics Ⅱ, Dynamics, Mechanical Engineering Lab, Mechanical Drawing and Lab, and Heat Transfer.

2) Students who choose MAE as their 2nd track can take additional required courses for the credits of elective courses.

3) Students who choose NSE as their 2nd track are required to take NSE213 Fundamentals of Nuclear Engineering course.



## 3. Curriculum ※ Opening courses are subject to change

## □ Mechanical and Aerospace Engineering (MAE)

### ▶ Required : Core

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MAE | MEN210 | Thermodynamics<br>열역학 | 3-3-0 | | 1 |
| | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| | MEN231 | Solid Mechanics Ⅱ<br>고체역학 Ⅱ | 3-3-0 | Prerequisite: MEN230 | 2 |
| | MEN250 | Mechanical Drawing and Lab<br>기계제도 및 실습 | 3-2-2 | | 1 |
| | MEN270 | Dynamics<br>동역학 | 3-3-0 | | 2 |
| | MEN300 | Mechanical Engineering Lab Ⅰ<br>기계공학실험 Ⅰ | 3-1-4 | Prerequisite: MEN231, MEN310 | 2 |
| | MEN310 | Heat Transfer<br>열전달 | 3-3-0 | Prerequisite: MEN210, MEN220 | 1 |
| Total Credit | | | 24 | | |

### ▶ Required : Selective[1)]

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MAE | MEN211 | Applied Thermodynamics<br>응용열역학 | 3-3-0 | Prerequisite: MEN210 | 2 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-2-2 | | 2 |
| | MEN320 | Applied Fluid Mechanics<br>응용유체역학 | 3-3-0 | Prerequisite: MEN220 | 1 |
| | MEN350 | Manufacturing Processes and Lab<br>기계공작법 및 실습 | 3-2-2 | Prerequisite: MEN230 | 1 |
| | MEN351 | Machine Element Design<br>기계요소설계 | 3-3-0 | Prerequisite: MEN231 | 2 |
| | MEN370 | Dynamic Systems and Control<br>시스템제어 | 3-3-0 | | 1 |
| Total Credit | | | 18 | | |

1) Selective requirements for the 1st track students: Take at least three out of six courses: Applied Thermodynamics, Numerical Analysis, Applied Fluid Mechanics, Manufacturing Processes and Lab, Machine Element Design, and Dynamic Systems and Control.

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MAE | MEN302 | Introduction to Finite Element Method<br>유한요소법개론 | 3-3-0 | Prerequisite: MEN230 | 2 |
| | MEN303 | Applied Engineering Mathematics<br>응용공학수학 | 3-3-0 | | 1 |
| | MEN352 | Creative Engineering Design Ⅰ (Capstone Design)<br>창의적공학설계 Ⅰ (캡스톤 디자인) | 3-1-4 | | 2 |
| | MEN400 | Mechanical Engineering Lab Ⅱ<br>기계공학실험 Ⅱ | 3-1-4 | Prerequisite: MEN231, MEN270, MEN310 | 1 |
| | MEN411 | Combustion<br>연소공학 | 3-3-0 | Prerequisite: MEN210, MEN220 | 1 |
| | MEN412 | Air-Conditioning and Refrigeration<br>공기조화냉동 | 3-3-0 | Prerequisite: MEN210 | 2 |
| | MEN413 | Computational Fluid Dynamics<br>전산유체역학 | 3-3-0 | Prerequisite: MEN301, MEN320 | 2 |
| | MEN414 | Design of Fluid Thermal Systems<br>열유체시스템 설계 | 3-3-0 | Prerequisite: MEN310 | 2 |
| | MEN415 | Aerodynamics<br>공기역학 | 3-3-0 | Prerequisite: MEN220 | 1 |
| | MEN420 | Introduction to Aerosol Technology<br>에어로졸 공학개론 | 3-3-0 | Prerequisite: MEN220 | 1 |
| | MEN431 | Introduction to Plastic Deformation<br>소성학개론 | 3-3-0 | Prerequisite: MEN231 | 1 |
| | MEN432 | Introduction to Mechanics of Composite Materials<br>복합재역학개론 | 3-3-0 | Prerequisite: MEN230 | 1 |
| | MEN451 | Introduction to MEMS<br>MEMS개론 | 3-3-0 | | 2 |
| | MEN452 | Creative Engineering Design Ⅱ (Capstone Design)<br>창의적공학설계 Ⅱ (캡스톤 디자인) | 3-1-4 | | 1 |
| | MEN453 | Computer Aided Engineering<br>컴퓨터이용공학 | 3-2-2 | | 1 |
| | MEN454 | Optimal Design<br>최적설계 | 3-2-2 | | 1 |
| | MEN457 | Introduction to Electric-Electronic Engineering<br>전기전자공학개론 | 3-3-0 | Prerequisite: PHY103 | 1 |
| | MEN461 | Introduction to Robotics<br>로봇공학 | 3-3-0 | | 2 |
| | MEN470 | Mechanical Vibration<br>기계진동학 | 3-3-0 | Prerequisite: MEN270 | 2 |
| | MEN481 | UAV Flight Control and Simulation<br>무인기 비행제어 및 시뮬레이션 | 3-3-0 | Prerequisite: MEN270, MEN370 | 1 |
| | MEN482 | UAV Navigation and Flight Computers<br>무인기 항법 및 운용 | 3-3-0 | Prerequisite: MEN270, MEN370 | 2 |
| | MEN497 | Special Topics in Mechanical Engineering Ⅰ<br>기계공학 특론 Ⅰ | 3-3-0 | | - |
| | MEN498 | Special Topics in Mechanical Engineering Ⅱ<br>기계공학 특론 Ⅱ | 3-3-0 | | - |
| | MEN499 | Special Topics in Mechanical Engineering Ⅲ<br>기계공학 특론 Ⅲ | 3-3-0 | | - |
| SDC | SDC405 | 3D Printing<br>3D 프린팅 | 3-3-0 | | 1 |
| UIE | UIE204 | Mechanics of Materials<br>재료역학 | 3-3-0 | | 2 |
| | UIE303 | Structural Analysis<br>구조역학 | 3-3-0 | | 1 |
| | UIE304 | Matrix Structural Analysis<br>매트릭스구조해석 | 3-3-0 | | 1 |
| | UIE408 | Introduction to Structural Dynamics<br>구조동역학개론 | 3-3-0 | | - |
| ID | IID201 | Design Elements and Principles<br>디자인요소와 원리 | 3-2-2 | | 1 |
| | IID221 | Design History & Contexts<br>디자인 역사와 맥락 | 3-3-0 | | 1 |
| AMS | AMS202 | Introduction to Materials Science and Engineering<br>재료공학개론 | 3-3-0 | Identical: SCM202, ENE216 | 1 |
| | AMS270 | Introduction to Polymer Materials<br>고분자재료개론 | 3-3-0 | | 2 |
| | AMS311 | Introduction to Metallic Materials<br>금속재료개론 | 3-3-0 | | - |
| SCM | SCM354 | Introduction to Semiconductor<br>반도체개론 | 3-3-0 | | 2 |
| BME | BME421 | Nano-Bioengineering<br>나노바이오공학 | 3-3-0 | | 2 |
| | | **Total Credit** | **108** | | |

## □ Nuclear Science and Engineering (NSE)

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| NSE | NSE213 | Fundamentals of Nuclear Engineering<br>원자력 공학 개론 | 3-3-0 | | 1 |
| | NSE214 | Introduction to Nuclear Fuel Cycle Engineering<br>핵주기공학 개론 | 3-3-0 | | 1 |
| | NSE221 | Nuclear Radiation Engineering & Experiment<br>원자력방사선공학 및 실험 | 3-2-2 | | 2 |
| | NSE222 | Nuclear Materials Engineering & Experiment<br>원자력재료공학 및 실험 | 3-2-2 | | 2 |
| | NSE223 | Nuclear Chemical Engineering<br>원자력화학공학 | 3-3-0 | | 2 |
| | NSE311 | Introduction to Nuclear Reactor Theory<br>원자로이론 개론 | 3-3-0 | | 2 |
| | NSE312 | Introduction to Nuclear Reliability Engineering<br>신뢰도 공학 개론 | 3-3-0 | | 1 |
| | NSE313 | Nuclear Fuel Engineering & Experiment<br>핵연료공학 및 실험 | 3-2-2 | | 1 |
| | NSE325 | Nuclear System Engineering & Experiment<br>원자로계통공학 및 실험 | 3-2-2 | | 2 |
| | NSE411 | Introduction to Radiation Materials Science<br>방사선 재료 과학 개론 | 3-3-0 | | 2 |
| | NSE330 | Fundamentals of Plasma Physics<br>플라즈마 물리학 기초 | 3-3-0 | | 1 |
| | NSE421 | Nuclear Reactor Lab<br>원자로실험 | 3-0-6 | | - |
| | NSE427 | Fundamentals of Nuclear Fusion<br>핵융합개론 | 3-3-0 | | 1 |
| | NSE457 | Principles of Nuclear Safety Design<br>원자력 안전 설계 원리 | 3-3-0 | | 1 |
| | NSE480 | Introduction to Nuclear Engineering IT<br>원자력 IT 개론 | 3-2-2 | | 2 |
| **Total Credit** | | | **45** | | |

### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| NSE | NSE216 | Fundamentals of Electromagnetics<br>전자기학개론 | 3-3-0 | | 1 |
| | NSE250 | Scientific Computation in Nuclear Fusion<br>전산핵융합기초 | 3-3-0 | | 2 |
| | NSE316 | Thermodynamics and Metallurgy of Nuclear Materials<br>원자력재료 열역학 | 3-3-0 | | 2 |
| | NSE317 | Basic MHD Renewable Energy Engineering<br>전자기 신재생 에너지공학 기초 | 3-3-0 | Prerequisite: NSE216 | 1 |
| | NSE318 | Nuclear Engineering Design and Lab Ⅰ<br>원자력공학종합설계프로젝트 Ⅰ | 2-0-4 | Capstone Design | 1 |
| | NSE326 | Nuclear Reactor Numerical Analysis<br>원자로 수치해석 | 3-3-0 | | 1 |
| | NSE327 | Radioactive Waste Management<br>방사성폐기물관리 | 3-3-0 | | 1 |
| | NSE328 | Nuclear Engineering Design and Lab Ⅱ<br>원자력공학종합설계프로젝트 Ⅱ | 2-0-4 | Capstone Design | 2 |
| | NSE329 | Nuclear Engineering Design and Lab Ⅲ<br>원자력공학종합설계프로젝트 Ⅲ | 2-0-4 | Capstone Design | 2 |
| | NSE350 | Introduction to perturbation methods<br>섭동방법론기초 | 3-3-0 | | 1 |
| | NSE351 | Introduction to plasma kinetic theory and nonlinear physics<br>플라즈마 운동 이론 기초 | 3-3-0 | | 2 |
| | NSE400 | Special Topics on Nuclear Engineering and Science Ⅰ<br>원자력공학 및 과학 특론 Ⅰ | 3-3-0 | | - |
| | NSE401 | Special Topics on Nuclear Engineering and Science Ⅱ<br>원자력공학 및 과학 특론 Ⅱ | 3-3-0 | | - |
| | NSE402 | Special Topics on Nuclear Engineering and Science Ⅲ<br>원자력공학 및 과학 특론 Ⅲ | 3-3-0 | | - |
| | NSE403 | Special Topics on Nuclear Engineering and Science Ⅳ<br>원자력공학 및 과학 특론 Ⅳ | 3-3-0 | | - |
| | NSE404 | Special Topics on Nuclear Engineering and Science Ⅴ<br>원자력공학 및 과학 특론 Ⅴ | 3-3-0 | | - |
| | NSE416 | Nuclear Engineering Design and Lab Ⅳ<br>원자력공학종합설계프로젝트 Ⅳ | 2-0-4 | Capstone Design | 1 |
| | NSE426 | Instrumentation and Control Systems<br>원전계측제어시스템 | 3-3-0 | | 2 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MAE | MEN210 | Thermodynamics<br>열역학 | 3-3-0 | | 1 |
| | MEN211 | Applied Thermodynamics<br>응용열역학 | 3-3-0 | Prerequisite: MEN210 | 2 |
| | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| | MEN270 | Dynamics<br>동역학 | 3-3-0 | | 2 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 2 |
| | MEN310 | Heat Transfer<br>열전달 | 3-3-0 | Prerequisite: MEN210, MEN220 | 1 |
| | MEN320 | Applied Fluid Mechanics<br>응용유체역학 | 3-3-0 | Prerequisite: MEN220 | 1 |
| | MEN457 | Introduction to Electric-Electronic Engineering<br>전기전자공학개론 | 3-3-0 | Prerequisite: PHY103 | 1 |
| SE | SCM202 | Introduction to Materials Science and Engineering<br>재료공학개론 | 3-3-0 | Identical: AMS202, ENE216 | 1 |
| | SCM203 | Physical Chemistry Ⅰ: Thermodynamics<br>재료물리화학 Ⅰ:열역학 | 3-3-0 | Identical: AMS203 | 1 |
| ENE | ENE212 | Physical Chemistry Ⅰ<br>물리화학 Ⅰ | 3-3-0 | Identical: ACE203, CHM231 | 1 |
| | ENE322 | Instrumental Anaysis<br>기기분석 | 3-3-0 | Identical: ACE391, CHM391 | 1 |
| | ENE416 | Introduction to Nanoscience and Nanotechnology<br>나노과학 및 기술 | 3-3-0 | Identical: ACE416, CHM371 | 1 |
| CSE | CSE232 | Discrete Mathematics<br>이산수학 | 3-3-0 | | 1,2 |
| | CSE341 | Principles of Programming Languages<br>프로그래밍언어 | 3-3-0 | Prerequisite: CSE241 | 1,2 |
| PHY | PHY204 | Electromagnetism Ⅱ<br>전자기학 Ⅱ | 3-3-0 | Prerequisite: PHY203 | 2 |
| | PHY301 | Quantum Physics Ⅰ<br>양자물리학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY303 | Thermal and Statistical Physics<br>열 및 통계물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| | PHY315 | Solid State Physics Ⅰ<br>고체물리학 Ⅰ | 3-3-0 | Prerequisite: PHY301 | 2 |
| | PHY427 | Introduction to Plasma Physics<br>플라즈마 물리학 입문 | 3-3-0 | | - |
| **Total Credit** | | | **113** | | |



## □ System Design and Control Engineering (SDC)

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SDC | SDC202 | Computational Tools for Engineers<br>공학전산기법 | 3-3-0 | | 2 |
| | SDC401 | Introduction to Mechatronics<br>메카트로닉스 개론 | 3-3-0 | | 1 |
| | SDC403 | Project Lab<br>프로젝트 랩 | 3-3-0 | | 1 |
| MAE | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| | MEN250 | Mechanical Drawing and Lab<br>기계제도 및 실습 | 3-2-2 | | 1 |
| | MEN270 | Dynamics<br>동역학 | 3-3-0 | | 2 |
| | MEN300 | Mechanical Engineering Lab Ⅰ<br>기계공학실험 Ⅰ | 3-1-4 | Prerequisite: MEN231, MEN310 | 2 |
| | MEN370 | Dynamic Systems and Control<br>시스템제어 | 3-3-0 | | 1 |
| **Total Credit** | | | **24** | | |

### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SDC | SDC302 | Circuit Theory & Lab<br>회로이론 및 실습 | 3-2-2 | | 1 |
| | SDC304 | Manufacturing System Design & Simulation<br>생산시스템설계 및 시뮬레이션 | 3-3-0 | | 2 |
| | SDC306 | System Dynamics<br>시스템 동역학 | 3-3-0 | | 2 |
| | SDC402 | Applied Robotics<br>응용로봇공학 | 3-3-0 | | 2 |
| | SDC405 | 3D Printing<br>3D 프린팅 | 3-3-0 | | 1 |
| | SDC410 | Special Topics in SDC Ⅰ<br>SDC 특론 Ⅰ | 3-3-0 | | 2 |
| | SDC420 | Special Topics in SDC Ⅱ<br>SDC 특론 Ⅱ | 3-3-0 | | - |
| | SDC430 | Special Topics in SDC Ⅲ<br>SDC 특론 Ⅲ | 3-3-0 | | - |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MAE | MEN210 | Thermodynamics<br>열역학 | 3-3-0 | | 1 |
| | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| | MEN231 | Solid Mechanics Ⅱ<br>고체역학 Ⅱ | 3-3-0 | Prerequisite: MEN230 | 2 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 2 |
| | MEN302 | Introduction to Finite Element Method<br>유한요소법개론 | 3-3-0 | Prerequisite: MEN230 | 2 |
| | MEN310 | Heat Transfer<br>열전달 | 3-3-0 | Prerequisite: MEN210, MEN220 | 1 |
| | MEN350 | Manufacturing Processes and Lab<br>기계공작법 및 실습 | 3-2-2 | Prerequisite: MEN230 | 1 |
| | MEN351 | Machine Element Design<br>기계요소설계 | 3-3-0 | Prerequisite: MEN231 | 2 |
| | MEN352 | Creative Engineering Design Ⅰ (Capstone Design)<br>창의적공학설계 Ⅰ (캡스톤 디자인) | 3-1-4 | | 2 |
| | MEN451 | Introduction to MEMS<br>MEMS개론 | 3-3-0 | | 2 |
| | MEN452 | Creative Engineering Design Ⅱ (Capstone Design)<br>창의적공학설계 Ⅱ (캡스톤 디자인) | 3-1-4 | | 1 |
| | MEN453 | Computer Aided Engineering<br>컴퓨터이용공학 | 3-2-2 | | 1 |
| | MEN470 | Mechanical Vibration<br>기계진동학 | 3-3-0 | Prerequisite: MEN270 | 2 |
| ID | IID232 | 3D CAD<br>3D CAD | 3-2-2 | | 2 |
| HFE | HFE301 | Experimental Design<br>실험계획법 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | HFE305 | Physical Computing<br>피지컬 컴퓨팅 | 3-2-2 | | 1 |
| CSE | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| MGE | MGE303 | Data Mining<br>데이터 마이닝 | 3-3-0 | | 1 |
| **Total Credit** | | | **78** | | |



▶ Other

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks |
|---|---|---|---|---|
| SDC | SDC201 | Engineering Drawing and Analysis<br>기계제도 및 해석 | 3-2-2 | Only opened upon request of retaking courses from students who already took the courses before.<br>(SDC301) Prerequisite: IID202 |
| | SDC301 | Introduction to Engineering Systems Design (Design Project 3)<br>공학 시스템 디자인 개론 (디자인 프로젝트 3) | 3-3-0 | |
| HSE | HSE207 | Engineering Mechanics<br>공학역학 | 3-3-0 | |
| | HSE308 | System Control<br>시스템 제어 | 3-3-0 | |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| MAE | <New> | ⇨ | MEN42001 (Elective)<br>Introduction to Aerosol Technology<br>에어로졸 공학개론 |
| NSE | <New> | ⇨ | NSE330 (Required)<br>Fundamentals of Plasma Physics<br>플라즈마 물리학 기초 |

## 5. Course Descriptions

### □ Mechanical and Aerospace Engineering (MAE)

**MEN210 Thermodynamics [열역학]**
Thermodynamics is the most fundamental course in Mechanical Engineering. This course aims to have students understand various fundamental laws of thermodynamics and to develop the ability to apply them to various thermal systems. It covers energy, heat and work, enthalpy, entropy, laws of thermodynamics, thermodynamic properties, analysis of cycle performance and various engineering cycles.

**MEN211 Applied Thermodynamics [응용열역학]**
This course is focused on the application of the principles of thermodynamics to understand the properties of ideal gas mixtures. Topics cover available energy, availability and second-law efficiency, chemical reactions, thermodynamic relations and phase and chemical equilibrium. The basics of molecular dynamics and statistical thermodynamics are introduced.

**MEN220 Fluid Mechanics [유체역학]**
This is an introductory course in Fluid Mechanics. Topics covered include fundamental concepts of fluid mechanics, fluid statics, governing equations in integral form, governing equations in differential form, Bernoulli equation, dimensional analysis, viscous flow in ducts, and boundary layer flows.

**MEN230 Solid Mechanics Ⅰ [고체역학Ⅰ]**
In this course, students perform an in-depth study on the concept of stress-strain analysis, based on statics (force and moment) and mechanics of deformable bodies. Students learn to analyze the force and moment applied on the cross-section of a beam subjected to tension, compression, bending, and torsion. Methods to determine stress-strain distribution and deflection of beams are presented. Energy methods based on the equilibrium between strain energy and external work, alternative to force-moment equilibrium, are also introduced.

**MEN231 Solid Mechanics Ⅱ [고체역학Ⅱ]**
This course builds upon Solid Mechanics and introduces the mechanical behavior of various materials, including metals, ceramics, polymers, and composites. A rigorous definition of three-dimensional stresses and strains is presented, based on which the mechanical behavior is analyzed. Students learn representative failure modes, including fracture, fatigue, wear, and creep, and methods are presented to predict the failure mode and life based on various failure criteria. Various case studies are performed to demonstrate failure analysis techniques.

**MEN250 Mechanical Drawing and Lab [기계제도 및 실습]**
This course is provided in two modes – lecture and lab – that run in parallel. In lectures, lines, projections, views, and tolerances, which are fundamental components of mechanical drawings, are presented. The lab component allows the students to apply the knowledge obtained in lectures to produce drawings utilizing CAD software. In the term project, 3-4 students work as a team to execute the project in a creative and practical manner. The projects will help students learn to work efficiently in a teamwork environment and improve their communication skills.

**MEN270 Dynamics [동역학]**
This course introduces various dynamics systems. For dynamics analysis, principles and applications of Newton's law, work-energy methods, and impulse-momentum methods will be covered in this course.

**MEN300 Mechanical Engineering Lab Ⅰ [기계공학실험Ⅰ]**
This course provides students with practical and experimental techniques for observation and measurement of mechanical principles and physical phenomena and focuses on analyzing experimental results and writing technical reports.

**MEN301 Numerical Analysis [수치해석]**
This course introduces numerical methods with emphasis on algorithm construction, analysis and implementation. It includes programming, round-off error, solutions of equations in one variable, interpolation and polynomial approximation, approximation theory, direct solvers for linear systems, numerical differentiation and integration, and initial-value problems for ordinary differential equations.

**MEN302 Introduction to Finite Element Method [유한요소법개론]**
In this course, the theory and formulation behind the finite element method will be introduced. To gain hands-on experience of the finite element method, practical applications in engineering will be covered.

**MEN303 Applied Engineering Mathematics [응용공학수학]**
This course provides a comprehensive, thorough, and up-to-date treatment of engineering mathematics. It is intended to introduce applied mathematics that are most relevant for solving practical problems to students of engineering, physics, mathematics, computer science, and related fields. A course in elementary calculus is the sole prerequisite.

**MEN310 Heat Transfer [열전달]**
This course deals with heat transfer problems associated with steady and transient conductions, forced and free convections, and radiation. Basic heat transfer mechanism, formulation of the problems and their solution procedures, and empirical correlations will be introduced. Also, some examples of practical applications will be discussed.

**MEN320 Applied Fluid Mechanics [응용유체역학]**
In this course, based on the topics learned in MEN220, advanced topics such as viscous flows, inviscid flows, lift and drag, basic turbulent flows, fundamentals of compressible flows, and turbomachinery will be covered.

### MEN350 Manufacturing Processes and Lab [기계공작법 및 실습]

The course introduces engineering materials used in industry from the perspectives of composition, microstructures, properties, and heat treatment. It provides an extensive knowledge of various manufacturing processes, develops basic mathematical descriptions for selected processes, and helps students apply these concepts to process selection and planning. Manufacturing processes ranging from traditional (casting, machining, forging, powder metallurgy, injection molding, welding) to nontraditional/cutting-edge (electrodischarge machining, rapid prototyping, microfabrication) are introduced. From the manufacturing standpoint, the students learn the advantages and limitations of various processes in terms of quality, cost, and productivity. The lab component of this course allows the students to design and manufacture mechanical components hands-on.

### MEN351 Machine Element Design [기계요소설계]

This course prepares students to design mechanical systems both at component- and system-level in a creative and comprehensive manner. Students learn to analyze, select, and synthesize machine components, as applied to springs, bearings, shafts, gears, fasteners, and other elements in a mechanical system. In addition, students learn to identify and quantify the specifications and trade-offs for the selection and application of components, which are commonly used in the design of complete mechanical systems. The course will require team projects in which the students will learn to develop conceptual design, optimize design parameters, and work efficiently in a teamwork environment.

### MEN352 Creative Engineering Design I [창의적공학설계 I ]

In this course, students will develop their design capabilities through a team-project. To accomplish a given objective, students should define the problem, design and manufacture the system, and evaluate the final product by themselves. Through the whole process, students can broaden their understanding about creative engineering design.

### MEN370 Dynamic Systems and Control [시스템제어]

Automatic control has played a vital role in various engineering and technological fields. It is not only important in space vehicles, missile guidance systems, aircraft autopiloting, and robots, but also in modern manufacturing and industrial processes. This course covers dynamic modeling and response of systems with mechanical, hydraulic, thermal and electrical elements, linear feedback control systems design, and analysis in time and frequency domains. Students learn basic mathematical and computational tools for modeling and analysis of dynamic systems. They are also trained to identify, model, analyze, design, and simulate dynamic systems in various engineering disciplines using a unified approach.

### MEN400 Mechanical Engineering Lab II [기계공학실험 II]

This is the second course of a two-semester sequence covering fundamentals of instrumentation and measurement and their application in engineering testing and experimentation. This course involves instructor-designed experiments and focuses on the application of the fundamental principles learned in MEN300 to more advanced tests and measurement applications.



### MEN411 Combustion [연소공학]

Combustion is based on thermodynamics, heat transfer, and fluid mechanics. This course deals with the energy conversion process from chemical to mechanical energy. Since energy consumption mostly occurs during the combustion process, the topics include not only flames and their characteristics but also practical combustion machines.

### MEN412 Air–conditioning and Refrigeration [공기조화냉동]

This course covers the basic engineering principles of air-conditioning and refrigeration systems based on the topics in thermodynamics, heat transfer, and fluid mechanics. Cooling load calculation methods, Psychrometric chart, Air-conditioning system design based on thermodynamic cycle analysis, and performance analysis for major components such as compressor, condenser, evaporator and expander are introduced. It also discusses various alternative refrigeration methods and refrigerants.

### MEN413 Computational Fluid Dynamics [전산유체역학]

This class is designed for use in introductory and intermediate courses in computational fluid dynamics (CFD) for students of aerospace engineering, mechanical engineering, and civil engineering with interest in fluid mechanics and heat transfer. Fundamental knowledge of programming and graphics is required for the applications of methods presented throughout the text. Since one learns a great deal by developing his or her own code to solve some partial differential equations, no program listing is included, and it is encouraged that students develop their own codes for the solutions of the proposed problems. For purposes of analysis, the numerical solutions of the sample problems are presented in tables. In the initial stage, the emphasis is on finite difference methods for solving parabolic, elliptic and hyperbolic equations, and in the final stage, the solution schemes is extended to the solution of a system of partial differential equations.

### MEN414 Design of Fluid Thermal Systems [열유체시스템설계]

This course covers various design methods for various practical applications related to thermal/fluid engineering such as fluid machineries, duct systems, heat exchangers, and heat pumps. In addition, this course covers design of energy production/conversion systems including future renewable energies such as hydropower, tidal power, wind power, solar photovolaics, geothermal energy, biomass energy, and fuel cells.

### MEN415 Aerodynamics [공기역학]

This course constitutes a solid study emphasizing inviscid, incompressible flow. Fluid mechanics is a prerequisite. Course topics include the review of fundamental principles and equations in fluid mechanics, fundamentals of inviscid, incompressible flow, incompressible flow over airfoils, and incompressible flow over finite wings.

### MEN420 Introduction to Aerosol Technology [에어로졸 공학개론]

Aerosols represent airborne solid particles or liquid droplets such as airborne fine dusts. The objectives of this course are

1. To understand and calculate the statistics of a given particle size distribution in the air.

2. To determine the movement of aerosols by a given transport mechanics (inertial movement, diffusion, electrical migration) and analyze the important mechanisms for a given aerosol system.
3. To design a system to generate aerosols, to collect aerosols, and to measure size distributions of aerosols. Fluid mechanics (MEN220) is a prerequisite.

### MEN431 Introduction to Plastic Deformation [소성학개론]

This course deals with the fundamental theory of plasticity including the constitutive relations in plastic deformation and the methods of analysis for grasping the deformation behavior. The analytic solution of nonlinear problems in plastic deformation will be covered.

### MEN432 Introduction to Mechanics of Composite Materials [복합재역학개론]

This course will introduce students to the fundamental mechanics of composite (more than one phase) solids. The primary objective of this course is to engage the students in important concepts related to material constitutive responses of composite materials at both micro- and macro- scales. Students should gain a basic understanding of the fundamental techniques used to analyze composite structures. Topics of the course will include effective stiffness properties of composites, constitutive description of laminated plates, and laminated plate theory. Failure theories and experimental results for laminated composites will also be discussed.

### MEN451 Introduction to MEMS [MEMS 개론]

This course introduces MEMS, one of the most typical interdisciplinary research areas. Physical principles of micro structure and micro-fabrication techniques will be taught first and case studies of design, fabrication, and applications of diverse micro devices including micro-mechanical sensors (accelerometer, pressure sensor, flow sensor, temperature sensor), micro-actuator, and microfluidics will be covered in this course.

### MEN452 Creative Engineering Design II [창의적공학설계 II]

In this course, students can develop their design ability as an independent mechanical engineer through a term-project where they propose an engineering problem including its necessity, design, manufacture, evaluate and present the system by themselves.

### MEN453 Computer Aided Engineering [컴퓨터이용공학]

In this course, students study the theories and algorithms of CAE used in the design and manufacture of various products. Through these studies, the students will develop their capabilities to design, analyse, and manufacture various products using CAE techniques.

### MEN454 Optimal Design [최적설계]

In this course, various optimization theories and algorithms are introduced, in order to improve students' capabilities in optimization including defining a problem, developing formulae, and adopting proper algorithms.



### MEN457 Introduction to Electric–Electronic Engineering [전기전자공학개론]

Introduction to electric-electronic engineering: This course is designed to provide the mechanical engineering students with basic electrical and electronic skills and knowledge required for experimental set-ups. For example, basic circuit theory, fundamental electromagnetics, op amp, dc power supply, diode, rectification circuits will be discussed.

### MEN461 Introduction to Robotics [로봇공학]

Robot definition, history, and its components/Open and closed loop Kinematics and inverse kinematics/ Jacobian and Inverse Jacobian/Dynamics/Actuators, sensors, vision, voice recognition/Robot Controls/Robot Projects

### MEN470 Mechanical Vibration [기계진동학]

This course introduces concepts of mechanical vibration, including free and forced vibration of single/ multi-degree of freedom systems. Relevance of eigenvalue problems to multiple DOF system analysis is introduced together with some numerical techniques. Finally, numerical approximation and techniques for the distributed systems are studied.

### MEN481 UAV Flight Control and Simulation [무인기 비행제어 및 시뮬레이션]

This course covers aircraft dynamic models, low-level flight control (autopilot) design, guidance, navigation, and high-level path planning for the autonomous operation of unmanned air vehicles (UAVs). Matlab/Simulink computer simulations will be used throughout the course to help students put theory into practice.

### MEN482 UAV Navigation and Flight Computers [무인기 항법 및 운용]

This course is intended to introduce to student (i) the basic concepts of signals and signals processing including UAV/Aircraft navigation data, (ii) the various instruments used for navigation, methods of processing the navigation data, choice of flight computers and issues related to flight software implementation, and (iii) practical experiences to develop a UAV, flight computer, or navigation system as a project.

### MEN497∼499 Special Topics in Mechanical Engineering I∼ III [기계공학 특론 I ∼ III]

In this course, special topics in mechanical engineering are discussed based on the knowledge of the principles of solid mechanics, dynamics, thermodynamics, fluid mechanics, heat transfer, manufacturing process, system design, and power system engineering. Topics may include machine design, advanced materials processing, laser-assisted manufacturing, micro/nano machining, MEMS, biomedical products, controls and mechatronics, acoustics and dynamics, tribology, heat problems in microchips and light emitting diodes, wind power, blood flow, micro/nanofluidics, heat exchanger design in nuclear power plants, and combustion in engines.

## □ Nuclear Science and Engineering (NSE)

### NSE213 Fundamentals of Nuclear Engineering [원자력 공학 개론]

This course deals with physical basics and engineered application of the nuclear energy and the main objective is to provide the student with general understanding and knowledge of the nuclear engineering. The fundamentals of nuclear physics and interaction of radiation with matters are studied. The basic principles of nuclear reactor are investigated and various nuclear reactor concepts are discussed. The nuclear energy conversion and radiation protection are studied as well.

### NSE214 Introduction to Nuclear Fuel Cycle Engineering [핵주기공학 개론]

This course introduces the nuclear fuel cycle which is the progression of nuclear fuel through a series of differing stages. It consists of steps in the front end, which are the preparation of the fuel, steps in the service period in which the fuel is used during reactor operation, and steps in the back end, which are necessary to safely manage, contain, and either reprocess or dispose of spent nuclear fuel. Depending on the reprocessing of the spent fuel, the specific topics include an open fuel cycle (or a once-through fuel cycle) and a closed fuel cycle considered in terms of sustainability of nuclear energy and nonproliferation. In particular, nuclear waste disposal (spent fuel) techniques will be discussed in terms of economics, safety and public acceptance.

### NSE216 Fundamentals of Electromagnetics [전자기학 개론]

This course focuses on the electromagnetic theories as a basis for plasma engineering, nuclear fusion, radiation and nuclear engineering. The basic concepts on electricity and magnetism are included. Specific topics will include vector algebra and calculus; electrostatics in material media for Coulomb's Law, Gauss's Law, and boundary-value problems; steady electric currents for Ohm's law and Kirchhoff's law; magnetostatics in magnetic media for Ampere's Law, Biot-Savart law, and vector potential; time-varying electromagnetics for Faraday's Law and Maxwell's equation.

### NSE221 Nuclear Radiation Engineering & Experiment [원자력방사선공학 및 실험]

The basic concepts and definition about radiation dosimetry are introduced and the biological effects on cells and human body organs are discussed. It also covers the generation, amplification, transfer and measurement of the electronic signal from various radiation detector based on the physics theory of the electronics signal and noise. The course also explores methods of radiation counting, timing and imaging system.

### NSE222 Nuclear Materials Engineering & Experiment [원자력재료공학 및 실험]

This subject introduces basic concepts and applications of materials science and engineering to nuclear energy systems, while laboratory practices are designed for experiencing property tests of the lectured materials. Lectures include the essential knowledge of materials science and engineering as well as the effects of radiation and environments on material properties. The experiments are concerned with mechanical test and data analysis, phase transformation, observation by optical and electron microscopes, corrosion tests and irradiation effects.



### NSE223 Nuclear Chemical Engineering [원자력화학공학]

This course will introduce students to the fundamental principles of nuclear chemical engineering as the first and foremost step to become scientists and engineers specialized in nuclear fuel cycle and radioactive waste management as well as nuclear materials and nuclear thermal hydraulics. At the end of this course, students will understand the fundamentals of chemical and electrochemical processes in nuclear power plants and nuclear fuel cycle systems.

### NSE250 Scientific Computation in Nuclear Fusion [전산핵융합기초]

This is an introductory course to various numerical methods and practical techniques of software development widely being used in scientific computation of diverse research fields including nuclear fusion. Students must be able to use one of low-level (C/C++/Fortran) or high-level (Python/Matlab) languages as prerequisite.

### NSE311 Introduction to Nuclear Reactor Theory [원자로이론 개론]

This course covers fundamental theory of nuclear fission reactors. Specific topics includes the followings: nuclear fission phenomenon, the chain nuclear reaction, diffusion/ moderation/absorption of neutron, multi-group neutron diffusion equations, heterogeneous reactor, reactor dynamics, reactivity and its change, perturbation theory and adjoint solutions, etc.

### NSE312 Introduction to Nuclear Reliability Engineering [신뢰도 공학 개론]

Reliability evaluation is very important in safety-critical systems such as nuclear power plants. This course is designed to provide undergraduate students with the fundamentals and principles for reliability engineering. The course will cover the basic knowledge of reliability engineering and probabilistic modelling methods.

### NSE313 Nuclear Fuel Engineering & Experiment [핵연료공학 및 실험]

This course introduces various nuclear fuels utilized in nuclear reactors worldwide. However, the focus is on low-enriched UO2 fuel used in light water reactors and metallic alloy fuels suitable for recycling the used nuclear fuel. It also provides students opportunity to deal with thermophysical and metallurgical experiments of uranium alloys and compounds. Possible nuclear fuel experiments to be included are as follows: 1) ceramic and alloy fuel fabrication and processing; 2) Phase transformation enthalpy and temperature measurement; 3) thermal conductivity measurement of nuclear fuel and cladding materials.

### NSE316 Thermodynamics and Metallurgy of Nuclear Materials [원자력재료 열역학]

Thermodynamics of materials is a good starting point to understand metallurgical behavior of nuclear materials usually being used under high temperature and high pressure environment, although nuclear fuel materials are apparently not in thermodynamic equilibrium for the most of their service time due to various types of radiations emitted from neutron-induced fission chain reactions. This course covers the very basics of thermodynamics and metallurgy of nuclear materials.

### NSE317 Basic MHD Renewable Energy Engineering [전자기 신재생 에너지공학 기초]

The basic concept on the electromagnetic electricity generation and its magnetohydrodynamic (MHD) characteristics of electrically conducting liquid metal is introduced. The course focuses on the fundamental approach in therms of the electromagnetics and fluid mechanics for the understanding the liquid metal flow in the magnetic environment and MHD/electromagnetic generator and pumps, which are used for sodium coolant circulation in a sodium fast reactor (SFR), one of the future generation IV reactors, and liquid lithium circulation in the blanket of a nuclear fusion reactor. Students learn the magnetohydrodynamic principle of the metal fluid flow and its application.

### NSE318 Nuclear Engineering Design and Lab I [원자력공학종합설계프로젝트 I]

In this course, students will have a chance to get the practical experience in nuclear fuels and fuel cycle, and nuclear fuel cladding and structural materials. In the nuclear fuels and fuel cycle area, students will first learn the fuel, fuel design criteria, fuel performance analysis code and then have a chance to analyze the in-reactor performance of the fuel. Then they will learn how to manufacture the fuel and have a chance to actually fabricate the fuel pellet with simulated material. Then they will be asked to analyze the results. In nuclear fuel cladding and structural materials area, students will learn the basic principles for the design and analysis of fuel cladding and structural components with commercial structural analysis code. And, material properties of fuel cladding and structural components will be reviewed and the proper material design and analysis using computational thermodynamics software will be practiced.

### NSE327 Radioactive Waste Management [방사성폐기물관리]

The objectives of this course are to provide student with an understanding of radioactive waste management requirements and practices, to make them aware of social, economic, and environmental concerns as well as technical research needs. This course will cover both high level waste including spent nuclear fuel and low and intermediate level waste including operation and decommissioning waste.

### NSE328 Nuclear Engineering Design and Lab II [원자력공학종합설계프로젝트 II]

Design of various nuclear fission energy systems and fast reactor technology require a variety of knowledge such as reactor physics, neutron data, radiation measurement and liquid metal magnetohydrodynamics. Through this course, students will learn how to  design and develop nuclear systems based on the above-mentioned knowledge. Students will participate in comprehensive design and lab activities such as 1) set up a design goal, 2) identify design parameters of the system and sketch the performance of the proposed system, 4) establish quantitative models and/or setup experimental devices that show the performance of the system, 5) identify multiple constraints in the project, and develop an optimized solution.

### NSE325 Nuclear System Engineering & Experiment [원자로계통공학 및 실험]

In this course, a variety of design constraints such as design principles, requirements, functions and technical specifications that govern the overall phases of design processes will be introduced to point out drawbacks and enhancement directions of nuclear systems. In addition, through implementations of small-scale mockups, an engineering chance realizing new ideas that are created by students would be provided.



### NSE326 Nuclear Reactor Numerical Analysis [원자로 수치해석]

The partial differential equations to be solved for real world nuclear engineering applications such as the nuclear reactor core design, core transient analysis, and core depletion calculations, cannot be solved analytically in most cases. Instead, computer can be utilized to obtain approximate solutions of the PDEs. This course covers techniques which can solve numerically the PDEs found in nuclear engineering, e.g., finite difference, finite element, and advanced nodal methods.

### NSE329 Nuclear Engineering Design and Lab III [원자력공학종합설계프로젝트 III]

This course covers (1) practical engineering and design problems and (2) quantitative safety assessment of nuclear reactor systems. For the first half of this course, students will learn a core thermal-hydraulic code and a safety analysis code for nuclear reactors. As a more advanced and visualized approach, students will also learn a 3D computational fluid dynamics code. The second half of the course is about probabilistic safety assessment (PSA), which quantitatively evaluates the safety of a nuclear power plant. Students will understand the PSA by analyzing a nuclear power plant PSA model and get skills such as event tree/fault tree analysis, human reliability analysis, and risk-informed applications.

### NSE330 Fundamentals of Plasma Physics [플라즈마 물리학 기초]

This is an introductory course of plasma physics for nuclear fusion. Objective of this course is for students to learn not only fundamental physics of plasmas and fusion but also continuous efforts of human being that have been made to achieve practical use of fusion energy. This course is focused on magnetohydrodynamic approach including plasma motion as fluids and waves, and diffusion of plasma, which is employed for nuclear fusion and MHD generation.

### NSE350 Introduction to perturbation methods [섭동방법론기초]

This course covers practical ordering techniques to solve or reduce differential equations analytically using asymptotic methods. Subjects of this class include but are not limited to asymptotic series, WKB method, method of averaging, method of multiple scales, and near-identity transformation.

### NSE351 Introduction to plasma kinetic theory and nonlinear physics [플라즈마운동이론기초]

This course covers fundamentals of kinetic theory and nonlinear physics for general plasmas. Specifically, microscopic phenomena in plasma are explored on account of particles' motion that are difficult to be handled and captured by fluid description. Also nonlinear physics explaining wave-particle interactions and wave-wave interactions is introduced. It is not necessary but recommended to take PHY427, "Introduction to Plasma Physics" first as prerequisite.

### NSE400~404 Special Topics on Nuclear Engineering and Science I~ V [원자력공학 및 과학 특론 I ~ V]

This course introduces new research topics in nuclear engineering and science.

### NSE411 Introduction to Radiation Materials Science [방사선 재료 과학 개론]

This course introduces fundamental theories and mechanisms of radiation interactions with materials assuming the students already took an introductory material science and engineering course. More specifically, the radiation damage process, the formalism for the prediction of the amount and spatial configuration of radiation damage produced by energetic particles, and eventual materials property degradation, will be covered.

### NSE416 Nuclear Engineering Design and Lab IV [원자력공학종합설계프로젝트 IV]

For the first half of this course, the students will be introduced to experimental research of various nuclear fuel material, such as 1) advanced nuclear fuel fabrication, 2) phase diagram investigation based on phase transformation measurement and crystallography utilizing differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and high temperature X-ray diffraction (XRD), 3) microscale metallurgy utilizing optical microscopy (OM) and scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS). The second half of the course is about experimental techniques on decontaminating radioactive waste and partitioning spent nuclear fuel. Students will understand experimental electrochemistry such as linear sweep voltametry (LSV), cyclic voltammetry (CV), and rotating disk electrode (RDE). Also, partitioning experiment using non-radioactive alloys will be performed.

### NSE421 Nuclear Reactor Lab [원자로실험]

Basic introduction to small research reactor will firstly given. Then experiments on important basic principles and to measure important physics parameters will be followed; basic reactor operation and criticality, measurement of reactor period and reactivity, experiment to measure critical mass, experiment to measure control rod worth, experiment to measure temperature coefficient of reactivity and experiment on neutron activation analysis.

### NSE426 Nuclear Power Plant Instrumentation and Control Systems [원전계측제어시스템]

This course provides the fundamentals of instrumentation and control (I&C) systems in nuclear power plants. The basic electronic engineering and principles of I&C will be introduced. Students will get fundamental knowledge and skills of I&C from lectures and experiments.

### NSE427 Fundamentals of Nuclear Fusion [핵융합개론]

This is an introductory course of nuclear fusion. This course covers necessity of harnessing fusion energy in facing energy crisis, principle of fusion reaction, design of magnetic fusion reactor, fusion plasma physics, plasma transport in the reactor, heating and current drive to sustain plasma, and future of fusion research.

### NSE457 Principles of Nuclear Safety Design [원자력 안전 설계 원리]

This course will familiarize students with the key safety systems and their safety functions employed at pressurized water reactors (PWRs). The reference PWR design for the course is the OPR1000 (Optimized Power Reactor 1000 MWe), but key similarities and differences of safety system configurations across the operating PWR fleet in Korea (Westinghouse/Framatome plants and APR1400) will be discussed. The safety systems studied are the High Pressure Safety System, Safety Injection Tanks, and Low Pressure Safety Injection System for safety injection, recirculation cooling, and residual heat removal safety function modes, Auxiliary Feedwater System, and Containment Spray System. Students will learn the engineering justification component selections such as pump type (positive displacement, centrifugal, and Terry turbine) and valve design and actuation methods. The engineering basis for regulatory acceptance criteria and how technical specifications are established is discussed.

### NSE480 Introduction to Nuclear Engineering IT [원자력 IT 개론]

This course covers basic computer and IT technology necessary for nuclear reactor physics analysis, thermal hydraulics system design, nuclear fuel performance analysis, nuclear material, radiation protection analysis, nuclear reactor safety analysis: Operating System (Windows, Linux), Computing Tools (Matlab, Mathematica, Labview), Programming Language (FORTRAN, C, JAVA), Script Language (Perl, Python, Batch File), Parallel Programming (OpenMP, MPI)

## □ System Design and Control Engineering (SDC)

### SDC201 Computational Tools for Engineers [공학전산기법]

This course studies essential and practical computational tools and methods for engineers and designers. Students will improve their understanding of computer programming and IT applications in engineering design. Practical laboratories and projects with MATLAB and LabView will complement the course.

### SDC302 Circuit Theory & Lab [회로이론 및 실습]

The aims of this course are to develop understanding of the principles and the fundamental concepts of circuit analysis, and to extend the students'ability to apply system analysis to other branches of engineering. This course integrates a number of concepts introduced in other courses in the disciplines of physics and mathematics. Students will see how abstract theoretical ideas work in practice. The course will focus on both hands-on experience and design practice.

### SDC304 Manufacturing System Design & Simulation [생산시스템설계 및 시뮬레이션]

This course studies manufacturing system configuration, process flow design and their evaluation. The student will learn the basic concepts and methods of simulation techniques to design and evaluate manufacturing systems in which all workcells, including robots, material handling systems and other auxiliary equipment are functioning to maximum efficiency and productivity.

### SDC401 Introduction to Mechatronics [메카트로닉스개론]

This course covers the basic control, instrumentation, and electrical systems. The course starts with an overall view of basic theories of signal processing and control. Based on such knowledge, various sensors

and actuators with a microcontroller will be introduced and used for lab experiments. MATLAB and Arduino will be intensively used for hands-on activities and class projects.

### SDC306 System Dynamics [시스템 동역학]

This course covers systematic lumped-parameter modeling, analysis, and simulation of multi-energy domain systems including mechanical, fluid, electrical, and thermal systems in temporal and frequency domains. Students will learn how to model multi-energy domain systems in a systematic manner using an energetic approach based on bond graph with analogies found between the domains, and can analyze those systems' characteristics and confirm the characteristics with simulations.

### SDC402 Applied Robotics [응용로봇공학]

This introduction to the basic modeling, design, planning, and control of robot systems provides a solid foundation for the principles behind robot design. Students will learn the basic methodologies and tools in robotics research and applications to move forward and experiment further in the robotics field.

### SDC403 Project Lab [프로젝트 랩]

Students and strategic partners from industry will work in project teams and undertake innovative technology development or product design projects involving product specification, conceptual design, detailed design and prototype-making/testing. The teams must aim to disseminate completed project outcomes to industry. The progress of each project will be reviewed based on formal presentations

### SDC405 3D Printing [3D 프린팅]

This course aims to introduce to the additive manufacturing (AM) technology and its applications. Students will examine various methods (i.g., Fused Deposition Method (FDM), Stereolithograpy (SLA), Selective Laser Sintering (SLS)) of additive manufacturing technologies, and understand the basic AM process from CAD models to the physical prototyping. In addition, contemporary issues in AM will be introduced, and assignments with FDM and SLS machines will be conducted during the course.

### SDC410, 420 Special Topics in SDC I, II [SDC 특론 I, II]

In these courses contemporary topics in various areas related to system design and control engineering will be covered. Topic selection will be made based upon special interests.





# School of Urban and Environmental Engineering

## 1. School Introduction

Environmental pollution and climate change caused by industrialization and urbanization are directly related to the survival of human society. With no surprise, studies on these issues are gaining in importance. Urban and environmental engineering is an interdisciplinary research field focusing on environmental protection and sustainable urban development with ultimately aiming toward the improvement of human welfare. In this division, students will gain fundamental knowledge related to urban and environmental issues, and will study more advanced courses represented by three tracks: Environmental Science and Engineering (environmental analysis, water and air treatment, climate change, global environment, environmental modeling), Urban Infrastructure Engineering (urban planning, structural mechanics and design, health monitoring, construction materials), and Disaster Management Engineering. The School of Urban and Environmental Engineering is committed to developing innovative technologies in the fields of urban and environmental engineering and educating leaders who will have a large impact on our profession and society.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Environmental Science and Engineering (ESE)

This track focuses on local as well as global issues related to environmental pollution and climate change. We provide a comprehensive collection of courses on important environmental subjects including pollution control and analysis, climate modelling, environmental fate models, remote sensing, and hydrology. Our mission is to educate students with the highest quality technical and professional standards and produce qualified professionals committed to challenge the environmental issues we face today.

#### 2) Urban Infrastructure Engineering [UIE]

The mission of the UIE track is to develop engineers with essential expertise in planning, design, construction, and management of urban built environment, who have the enthusiastic nature of their special role in the

future of human society. The UIE program consists of major disciplines in urban and civil engineering, such as urban planning, construction materials, structural mechanics and design, smart sensing and control, and geotechnical engineering. Through innovative education and research, the students will develop dynamic abilities on creating sustainable and resilient urban infrastructure systems for our future generations.

### 3) Disaster Management Engineering (DME)

The Disaster Management Engineering track provides an interdisciplinary undergraduate education, integrating the diverse expertise of urban/civil engineering, environmental engineering and earth/climate engineering to mitigate the impact of unexpected disasters. The track focuses on (1) natural hazard monitoring/prediction; (2) sustainable and resilient infrastructure; (3) disaster risk reduction/prevention; and (4) water resources and flood management.

## □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| ESE | Required | 6 | 6 | |
| | Elective | 48 | 12 | |
| UIE | Required | 18 | 9 | |
| | Elective | 36 | 9 | |
| DME | Required | 18 | 9 | |
| | Elective | 36 | 9 | |

## □ Fundamental Course for each track

### ▶ Required Mathematics Course for Each Track

| Track | Course No. | Course Title | Semester |
|---|---|---|---|
| ESE | MTH201 | Differential Equations | 2-1 |
| | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |
| UIE | MTH201 | Differential Equations | 2-1 |
| | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |
| DME | MTH201 | Differential Equations | 2-1 |
| | MTH203 or MTH211 | Applied Linear Algebra or Statistics | 2-2 |

※ Complete based on 1TR

※ Engineering field students who entered in 2009 should take 'Calculus (or I), Applied Linear Algebra, Differential Equations, Statistics' 12 credits.



### ▶ Fundamentals required to Business field students when they choose Engineering field tracks as 2nd track

| Course No. | ESE | UIE | DME |
|---|---|---|---|
| Differential Equations | ✓ | ✓ | ✓ |

## 3. Curriculum ※ Opening courses are subject to change

## □ Environmental Science and Engineering (ESE)

* 1st Track : Students must take more than 36 credits of courses whose codes start with “ESE”
* 2nd Track : Students must take more than 12 credits of courses whose codes start with “ESE”

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ESE | ESE201 | Introduction to Environmental Engineering<br>환경공학개론 | 3-3-0 | | 1 |
| | ESE203 | Earth and Environmental Sciences<br>지구환경과학 | 3-3-0 | | 1 |
| | | **Total Credit** | **6** | | |

### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ESE | ESE202 | Environmental Chemistry<br>환경화학 | 3-3-0 | | 1 |
| | ESE204 | Water Pollution<br>수질오염 | 3-3-0 | | 2 |
| | ESE205 | Air Pollution<br>대기오염 | 3-3-0 | | 2 |
| | ESE232 | Atmosphere and Ocean Sciences<br>대기해양과학 | 3-3-0 | | 2 |
| | ESE233 | Atmospheric Physics<br>대기물리 | 3-3-0 | | - |
| | ESE241 | Environmental Mathematics<br>환경수학 | 3-3-0 | | - |
| | ESE242 | Environmental Colloids Science<br>환경콜로이드과학 | 3-3-0 | | - |
| | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| | ESE311 | Water Treatment Engineering<br>수처리공학 | 3-3-0 | | - |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ESE | ESE312 | Soil Pollution<br>토양오염 | 3-3-0 | | - |
| | ESE313 | Aquatic Chemistry Laboratory<br>수질화학실험 | 3-2-2 | | - |
| | ESE314 | Environmental Data Analysis and Practice<br>환경데이터분석 | 3-3-0 | | 1 |
| | ESE331 | Analysis of Pollutants<br>오염물질분석/실험 | 3-2-2 | | 1 |
| | ESE333 | Introduction to Remote Sensing<br>원격탐사개론 | 3-3-0 | | 1 |
| | ESE334 | Atmospheric Dynamics<br>대기역학 | 3-3-0 | | - |
| | ESE335 | Biogeochemistry<br>생지화학 | 3-3-0 | | - |
| | ESE337 | Environmental Thermodynamics<br>환경열역학 | 3-3-0 | | 1 |
| | ESE341 | Environmental Aquatic Organic Chemistry<br>환경수유기화학 | 3-3-0 | | - |
| | ESE411 | Water and Wastewater Engineering<br>상하수도공학 | 3-3-0 | | 1 |
| | ESE412 | Environmental Remediation<br>환경복원 | 3-3-0 | | - |
| | ESE413 | Waste Management<br>폐기물처리/재활용 | 3-3-0 | | - |
| | ESE414 | Environmental Bioprocess<br>환경생물공정 | 3-3-0 | | 2 |
| | ESE415 | Environmental Toxicology<br>환경독성학 | 3-3-0 | | - |
| | ESE416 | Hydraulics<br>수리학 | 3-3-0 | | 2 |
| | ESE417 | Water Treatment Modeling: Principles and Practice<br>수처리모델링 | 3-3-0 | | 2 |
| | ESE418 | Advances in Water Quality Modeling<br>고급 수질 모델링 | 3-3-0 | | 1 |
| | ESE421 | Special Topics in Environmental Engineering Ⅰ<br>환경공학특론 Ⅰ | 3-3-0 | | 1 |
| | ESE422 | Special Topics in Environmental Engineering Ⅱ<br>환경공학특론 Ⅱ | 3-3-0 | | - |
| | ESE423 | Special Topics in Environmental Engineering Ⅲ<br>환경공학특론 Ⅲ | 3-3-0 | | - |
| | ESE431 | Climate Dynamics<br>기후역학 | 3-3-0 | Prerequisite: ESE232, ESE334 | 1 |
| | ESE432 | Earth Environment Numerical Analysis<br>지구환경전산실습 | 3-2-2 | | 1 |
| | ESE434 | Climate Change Engineering<br>기후변화공학 | 3-3-0 | | 2 |
| | ESE435 | GIS-Based Modeling<br>GIS 기반 모델링 | 3-3-0 | | 2 |
| | ESE436 | Statistics in Earth and Environmental Sciences<br>지구환경통계학 | 3-3-0 | | - |
| | ESE437 | Multimedia Environmental Modelling<br>다매체환경모델링 | 3-3-0 | | 2 |
| | ESE441 | Special Topics in Earth Science Ⅰ<br>지구환경특론 Ⅰ | 3-3-0 | | - |
| | ESE442 | Special Topics in Earth Science Ⅱ<br>지구환경특론 Ⅱ | 3-3-0 | | - |
| | ESE443 | Special Topics in Earth Science Ⅲ<br>지구환경특론 Ⅲ | 3-3-0 | | - |
| UIE | UIE210 | Geographic Information System<br>지리정보시스템 | 3-3-0 | | 2 |
| DME | DME201 | Introduction to Natural Hazards<br>자연재해개론 | 3-3-0 | | 1 |
| | DME221 | Atmospheric Chemistry<br>대기화학 | 3-3-0 | | - |
| | DME311 | Probability Concepts in Engineering<br>공학확률 | 3-3-0 | | 2 |
| | DME321 | Numerical Modeling and Analysis<br>수치모델링 및 분석 | 3-3-0 | | 2 |
| | DME342 | Hydrology<br>수문학 | 3-3-0 | | - |
| | DME421 | Weather Analysis and Prediction<br>날씨 분석 및 예측 | 3-3-0 | Prerequisite: DME201 | 2 |
| | DME422 | Satellite Remote Sensing<br>위성원격탐사 | 3-3-0 | | - |
| MEN | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| BIO | BIO331 | Microbiology<br>미생물학 | 3-3-0 | | 1 |
| CHM | CHM211 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | | 1 |
| | CHM212 | Organic Chemistry Ⅱ<br>유기화학 Ⅱ | 3-3-0 | | 2 |
| | CHM231 | Physical Chemistry Ⅰ<br>물리화학 Ⅰ | 3-3-0 | | 1 |
| | CHM232 | Physical Chemistry Ⅱ<br>물리화학 Ⅱ | 3-3-0 | | 2 |
| | CHM391 | Instrumental Analysis<br>기기분석 | 3-3-0 | | 2 |
| | | **Total Credit** | **159** | | |

## □ Urban Infrastructure Engineering (UIE)

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| UIE | UIE201 | Introduction to Civil Engineering<br>건설공학개론 | 3-3-0 | | 1 |
| | UIE203 | Introduction to Urban Planning<br>도시계획개론 | 3-3-0 | | 1 |
| | UIE204 | Mechanics of Materials<br>재료역학 | 3-3-0 | Prerequisite: UIE201 | 2 |
| | UIE210 | Geographic Information System<br>지리정보시스템 | 3-3-0 | | 2 |
| **Total Credit** | | | **12** | | |

### ▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| UIE | UIE303 | Structural Analysis<br>구조역학 | 3-3-0 | Prerequisite: UIE204 | 1 |
| DME | DME311 | Probability Concepts in Engineering<br>공학확률 | 3-3-0 | | 2 |
| **Total Credit** | | | **6** | | |

### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| UIE | UIE202 | Sustainable Design<br>환경설계론 | 3-1-4 | | - |
| | UIE301 | Urban Transportation Planning<br>교통계획 | 3-3-0 | | 1 |
| | UIE304 | Matrix Structural Analysis<br>매트릭스구조해석 | 3-3-0 | | 1 |
| | UIE305 | Soil Mechanics<br>토질역학 | 3-3-0 | | 1 |
| | UIE306 | Concrete Structures<br>콘크리트구조공학 | 3-3-0 | Prerequisite: UIE204 | - |
| | UIE307 | Properties of Concrete<br>콘크리트재료공학 | 3-2-2 | | 2 |
| | UIE308 | Structural Engineering Lab<br>구조공학실험 | 3-1-4 | Prerequisite: UIE204 | 1 |
| | UIE309 | Urban Development<br>도시개발론 | 3-3-0 | | - |
| | UIE401 | Steel Structures<br>강구조공학 | 3-3-0 | Prerequisite: UIE204 | - |
| | UIE402 | Design of Structural Systems<br>구조시스템설계 | 3-3-0 | | - |
| | UIE403 | Foundation Engineering<br>기초공학 | 3-3-0 | | 2 |
| | UIE404 | Infrastructure Engineering<br>사회기반시설공학 | 3-3-0 | | - |
| | UIE405 | Urban Design<br>도시설계 | 3-3-0 | | - |
| | UIE408 | Introduction to Structural Dynamics<br>구조동역학개론 (구조진동론) | 3-3-0 | | - |
| | UIE409 | Construction Materials<br>건설재료공학 | 3-3-0 | Prerequisite: UIE201 | 2 |
| | UIE410 | Special Topics in Urban Infrastructure Engineering Ⅰ<br>도시건설공학특론 Ⅰ | 3-3-0 | | - |
| | UIE411 | Special Topics in Urban Infrastructure Engineering Ⅱ<br>도시건설공학특론 Ⅱ | 3-3-0 | | - |
| | UIE412 | Special Topics in Urban Infrastructure Engineering Ⅲ<br>도시건설공학특론 Ⅲ | 3-3-0 | | - |
| ESE | ESE201 | Introduction to Environmental Engineering<br>환경공학개론 | 3-3-0 | | 1 |
| | ESE233 | Atmospheric Physics<br>대기물리 | 3-3-0 | | - |
| | ESE242 | Environmental Colloids Science<br>환경콜로이드과학 | 3-3-0 | | - |
| | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| | ESE314 | Environmental Data Analysis and Practice<br>환경데이터분석 | 3-3-0 | | 1 |
| | ESE333 | Introduction to Remote Sensing<br>원격탐사개론 | 3-3-0 | | 2 |
| | ESE411 | Water and Wastewater Engineering<br>상하수도공학 | 3-3-0 | | 1 |
| | ESE416 | Hydraulics<br>수리학 | 3-3-0 | | 2 |
| | ESE417 | Water Treatment Modeling:<br>Principles and Practice<br>수처리모델링 | 3-3-0 | | 2 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ESE | ESE418 | Advances in Water Quality Modeling<br>고급수질모델링 | 3-3-0 | | 1 |
| | ESE435 | GIS-Based Modeling<br>GIS 기반 모델링 | 3-3-0 | | 1 |
| DME | DME321 | Numerical Modeling and Analysis<br>수치모델링 및 분석 | 3-3-0 | | 2 |
| | DME331 | Disaster Management<br>재난관리 | 3-3-0 | | 1 |
| | DME332 | Disaster Risk Analysis<br>재난위험성 분석 (도시방재학) | 3-3-0 | | - |
| | DME342 | Hydrology<br>수문학 | 3-3-0 | | - |
| | DME422 | Satellite Remote Sensing<br>위성원격탐사 | 3-3-0 | | - |
| | DME431 | Disasters and Environmental Economics<br>재난 및 환경경제학 | 3-3-0 | | - |
| | DME432 | Vulnerability and Capacity Analysis<br>재해취약성 및 수용력분석 | 3-3-0 | Prerequisite: UIE210 | - |
| MEN | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| MGT | MGT211 | Microeconomics<br>미시경제학 | 3-3-0 | Prerequisite: MGT106 | 2 |
| | MGT315 | Econometrics<br>계량경제학 | 3-3-0 | Prerequisite: MGT211 | - |
| **Total Credit** | | | **117** | | |

## □ Disaster Management Engineering (DME)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| DME | DME201 | Introduction to Natural Hazards<br>자연재해개론 | 3-3-0 | | 1 |
| | DME311 | Probability Concepts in Engineering<br>공학확률 | 3-3-0 | | 2 |
| | DME331 | Disaster Management<br>재난관리 | 3-3-0 | | 1 |
| **Total Credit** | | | **9** | | |

▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ESE | ESE201 | Introduction to Environmental Engineering<br>환경공학개론 | 3-3-0 | | 1 |
| UIE | UIE201 | Introduction to Civil Engineering<br>건설공학개론 | 3-3-0 | | 1 |
| | UIE203 | Introduction to Urban Planning<br>도시계획개론 | 3-3-0 | | 1 |

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| DME | DME202 | Man-made Disasters<br>인적재해 | 3-3-0 | | - |
| | DME221 | Atmospheric Chemistry<br>대기화학 | 3-3-0 | | - |
| | DME321 | Numerical Modeling and Analysis<br>수치모델링 및 분석 | 3-3-0 | | 2 |
| | DME332 | Disaster Risk Analysis<br>재난위험성 분석 (도시방재학) | 3-3-0 | | - |
| | DME341 | Water Resources Engineering<br>수자원공학 | 3-3-0 | | - |
| | DME342 | Hydrology<br>수문학 | 3-3-0 | | - |
| | DME411 | Hazard Analysis for System Safety<br>재해분석과 시스템안전성 | 3-3-0 | | - |
| | DME421 | Weather Analysis and Prediction<br>날씨 분석 및 예측 | 3-3-0 | Prerequisite: DME201 | 2 |
| | DME422 | Satellite Remote Sensing<br>위성원격탐사 | 3-3-0 | | - |
| | DME431 | Disasters and Environmental Economics<br>재난 및 환경경제학 | 3-3-0 | | - |
| | DME432 | Vulnerability and Capacity Analysis<br>재해취약성 및 수용력분석 | 3-3-0 | Prerequisite: UIE210 | - |
| | DME491 | Special Topics in Disaster Management Engineering Ⅰ<br>재난관리공학특론 Ⅰ | 3-3-0 | | - |
| | DME492 | Special Topics in Disaster Management Engineering Ⅱ<br>재난관리공학특론 Ⅱ | 3-3-0 | | 2 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| DME | DME493 | Special Topics in Disaster Management Engineering Ⅲ<br>재난관리공학특론 Ⅲ | 3-3-0 | | - |
| ESE | ESE203 | Global Environment<br>지구환경 | 3-3-0 | | 1 |
| | ESE204 | Water Pollution<br>수질오염 | 3-3-0 | | 2 |
| | ESE205 | Air Pollution<br>대기오염 | 3-3-0 | | 2 |
| | ESE232 | Atmosphere and Ocean Sciences<br>대기해양과학 | 3-3-0 | | 2 |
| | ESE233 | Atmospheric Physics<br>대기물리 | 3-3-0 | | - |
| | ESE242 | Environmental Colloids Science<br>환경콜로이드과학 | 3-3-0 | | - |
| | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| | ESE311 | Water Treatment Engineering<br>수처리공학 | 3-3-0 | | - |
| | ESE312 | Soil Pollution<br>토양오염 | 3-3-0 | | - |
| | ESE314 | Environmental Data Analysis and Practice<br>환경데이터분석 | 3-3-0 | | 1 |
| | ESE333 | Introduction to Remote Sensing<br>원격탐사개론 | 3-3-0 | | 1 |
| | ESE334 | Atmospheric Dynamics<br>대기역학 | 3-3-0 | | - |
| | ESE411 | Water and Wastewater Engineering<br>상하수도공학 | 3-3-0 | | 1 |
| | ESE412 | Environmental Remediation<br>환경복원 | 3-3-0 | | - |
| | ESE416 | Hydraulics<br>수리학 | 3-3-0 | | 2 |
| | ESE417 | Water Treatment Modeling: Principles and Practice<br>수처리모델링 | 3-3-0 | | 2 |
| | ESE418 | Advances in Water Quality Modeling<br>고급수질모델링 | 3-3-0 | | 1 |
| | ESE435 | GIS-Based Modeling<br>GIS 기반 모델링 | 3-3-0 | | 2 |
| UIE | UIE204 | Mechanics of Materials<br>재료역학 | 3-3-0 | Prerequisite: UIE201 | 2 |
| | UIE210 | Geographic Information System<br>지리정보시스템 | 3-3-0 | | 2 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| UIE | UIE301 | Urban Transportation Planning<br>교통계획 | 3-3-0 | | 1 |
| | UIE303 | Structural Analysis<br>구조역학 | 3-3-0 | Prerequisite: UIE204 | 1 |
| | UIE304 | Matrix Structural Analysis<br>매트릭스구조해석 | 3-3-0 | | 1 |
| | UIE305 | Soil Mechanics<br>토질역학 | 3-3-0 | | 1 |
| | UIE306 | Concrete Structures<br>콘크리트구조공학 | 3-3-0 | Prerequisite: UIE204 | - |
| | UIE307 | Properties of Concrete<br>콘크리트재료공학 | 3-2-2 | | 2 |
| | UIE308 | Structural Engineering Lab<br>구조공학실험 | 3-1-4 | Prerequisite: UIE204 | 1 |
| | UIE309 | Urban Development<br>도시개발론 | 3-3-0 | | - |
| | UIE401 | Steel Structures<br>강구조공학 | 3-3-0 | Prerequisite: UIE204 | - |
| | UIE403 | Foundation Engineering<br>기초공학 | 3-3-0 | | 2 |
| | UIE404 | Infrastructure Engineering<br>사회기반시설공학 | 3-3-0 | | - |
| | UIE405 | Urban Design<br>도시설계 | 3-3-0 | | - |
| | UIE408 | Introduction to Structural Dynamics<br>구조동역학개론 (구조진동론) | 3-3-0 | | - |
| | UIE409 | Construction Materials<br>건설재료공학 | 3-3-0 | Prerequisite: UIE201 | 2 |
| MEN | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| | | **Total Credit** | **147** | | |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| ESE | <New> | ⇨ | ESE233 (Elective)<br>Atmospheric Physics<br>대기물리 |
| | <New> | ⇨ | ESE418 (Elective)<br>Advances in Water Quality Modeling<br>고급 수질 모델링 |
| | ESE201 (Required)<br>Global Environment<br>지구환경 | ⇨ | ESE201 (Required)<br>Earth and Environmental Sciences<br>지구환경과학 |
| | ESE333 (Required)<br>Introduction to Remote Sensing<br>원격탐사개론<br>2nd semester | ⇨ | ESE333 (Elective)<br>Introduction to Remote Sensing<br>원격탐사개론<br>1st semester |
| | ESE337 (Required)<br>Environmental Thermodynamics<br>환경열역학 | ⇨ | ESE337 (Elective)<br>Environmental Thermodynamics<br>환경열역학 |
| | ESE435 (Elective)<br>GIS-Based Modeling<br>GIS 기반 모델링<br>1st semester | ⇨ | ESE435 (Elective)<br>GIS-Based Modeling<br>GIS 기반 모델링<br>2nd semester |
| | ESE437 (Elective)<br>Multimedia Environmental Modeling<br>다매체환경모델링<br>Prerequisite : ESE331 | ⇨ | ESE437 (Elective)<br>Multimedia Environmental Modeling<br>다매체환경모델링<br>Prerequisite : - |
| UIE | UIE310 (Elective)<br>Soil Dynamics<br>토질동역학 (지반동역학) | ⇨ | Deletion |
| DME | DME421 (Elective)<br>Weather Analysis and Prediction<br>날씨분석및예측<br>Prerequisite : DME201, ESE334 | ⇨ | DME421 (Elective)<br>Weather Analysis and Prediction<br>날씨분석및예측<br>Prerequisite : DME201 |



## 5. Course Descriptions

### □ Environmental Science and Engineering (ESE)

**ESE201 Introduction to Environmental Engineering [환경공학개론]**
For students majoring in “Environmental Engineering”, this course deals with basic concepts of environmental research fields, such as air, water, soil, waste and microbiology.

**ESE202 Environmental Chemistry [환경화학]**
The goal of this course is to study basic knowledge of chemistry to identify natural phenomena in air, water and soil systems and to develop students’ ability to apply this knowledge for the remediation of the environment contaminated by toxic chemical compounds.

**ESE203 Earth and Environmental Sciences [지구환경과학]**
The aim of this course is to comprehensively understand various environmental problems, such as geophysical and chemical phenomena, on the basis of earth and environmental sciences. Human influences such as urbanization, industrialization and the increased use of fossil energy will be studied as major causes of global warming, environmental pollution, stratospheric ozone depletion and the desertification process. Students are encouraged to participate in the class by group or individual presentation of their own research on selected problems.

**ESE204 Water Pollution [수질오염]**
The reasons for water pollution and the characteristics of water pollutants will be studied. On the basis of this knowledge, the analytical methods for various water pollutants and removal mechanisms will be discussed.

**ESE205 Air Pollution [대기오염]**
The physico-chemical characteristic of air pollutants, long-range transport, hazardous effects and emission reduction will be studied.

**ESE232 Atmosphere and Ocean Sciences [대기해양과학]**
This course is an introduction to the dynamics and phenomenology of Earth''s atmosphere and ocean circulations. Special emphasis is placed in understanding how energy and momentum transports are effected in the atmosphere and oceans, and how they influence Earth''s climate.

**ESE233 Atmosphereic Physics [대기물리]**
This course provides students theory and principle of atmospheric radiation, relating to the absorption, reflection, and scattering by the atmospheric compositions. It provides the basic theory of radiative transfer in the atmosphere. In addition, the application of radiative transfer theory will be introduced to the remote sensing observation and climate change studies.

### ESE241 Environmental Mathematics [환경수학]
Mathematics is one of tools to be used to understand and analyze the environmental problems, with various environmental science knowledge, as those have somewhat different methodologies towards solutions to existing environmental problems. This course includes fundamentals of math., such as linear algebra and partial differential equations, and applications with respect to transport phenomena of particles and colloids in aquatic environments.

### ESE242 Environmental Colloids Science [환경콜로이드과학]
The environmental colloids Science includes both science and mathematics of colloids in environmental engineering. Colloids range in size from macromolecules to colloidal particles. Colloids move in different patterns, such as diffusion and convection, thus, we try to reveal the colloidal behaviors with both physico-chemical scientific and mathematical ways. Through the course, we are expected to understand those behaviors of various colloids with respect to control ot colloids.

### ESE243 Science Humanities [과학인문학]
This course starts from being interested in crisis of our planet from the climate change and with problems in our society. We understand we have been doing our best to solve the issues in scientific and political ways but those seem to come up with something ineffective. Thus, I suggest we discuss in somewhat different ways, including both science and humanities. I would have subtopic of “Science Walden” that we are performing the project, with the problems of our era, including climate chang, inequality, and many others.

### ESE311 Water Treatment Engineering [수처리공학]
This course will provide comprehensive coverage of water treatment facility design emphasizing coagulation, flocculation, sedimentation, filtration, disinfection, redox reactions and adsorption.

### ESE312 Soil Pollution [토양오염]
This course covers the wide range of soil pollution studies, including reasons for soil pollution, environmental impact of soil pollution and the remediation and treatment of polluted soils.

### ESE313 Aquatic Chemistry Laboratory [수질화학실험]
This course covers basic principles and laboratory techniques for the analysis of fresh water, contaminated waters and waste waters, with an emphasis on instrumental techniques.

### ESE314 Environmental Data Analysis and Practice [환경데이터분석]
This course delivers the basic knowledge on environmental data analysis and provides some practices using MATLAB. This course begins with basic MATLAB techniques to visualize statistical results, including very basic elements of environmental statistics. I welcome anyone who is interested in environmental data analysis.



### ESE331 Analysis of Pollutants [오염물질분석/실험]
In this course, the principle of instrumental analysis for various pollutants from different environmental media will be studied. Furthermore, experimental skills for the analysis of pollutants will be obtained.

### ESE333 Introduction to Remote Sensing [원격탐사개론]
This course provides a qualitative and quantitative introduction to the fundamentals of acquiring, analyzing and utilizing remote sensing data in the performance of environmental monitoring and natural resource inventories. This course introduces key applications of remote sensing as well as basic digital image processing techniques (e.g. image enhancement, image classification). The students will use the state-of-the-art software and hardware to examine satellite and airborne remote sensing data.

### ESE334 Atmospheric Dynamics [대기역학]
Atmospheric dynamics is the study of lareg-scale atmospheric motions associated with weather and climate. Atmospheric dynamics is the study of large-scale atmospheric motions associated with weather and climate. A basic assumption for describing such motions is to regard the atmosphere as a continuous fluid medium and apply the fundamental conservation laws of mass, momentum, and thermodynamic energy, which are expressed in terms of partial differential equations over space and time. Solving those differential equations with some systematic simplifications based on observations, the students will obtain physical insights to the role of atmospheric motions in determining the observed weather and climate. The class will cover in depth the Chapters 1-6 of An Introduction to Dynamic Meteorology written by James R. Holton. The presented topics include fundamental and apparent forces, basic conservation laws, circulation and vorticity, atmospheric motion in the presence of friction, and the quasi-geostrophic analysis of large-scale atmospheric motion.

### ESE335 Biogeochemistry [생지화학]
Biogeochemistry is the scientific discipline that involves the study of the chemical, physical, geological, and biological processes and reactions that govern the composition of the natural environment. This course focuses on stable isotope biogeochemistry with emphasis on carbon, oxygen, and nitrogen. Theoretical principles, isotope fractionation, and variation of isotopes in nature with emphasis on the ocean, atmosphere, and biosphere will be presented and discussed. Stable isotope techniques, applications of stable isotopes in research, and introduction to mass spectrometry will form the applied component of the course.

### ESE337 Environmental Thermodynamics [환경열역학]
This course offers the basic understanding of thermodynamics relating to environmental and atmospheric fields and covers the fundamental laws of thermodynamics, properties of fluids, heat effects, and phase equilibria.

### ESE341 Environmental Aquatic Organic Chemistry [환경수유기화학]
Both natural and synthetic organic chemicals are abundant in environments, in waters including air, surface and ground water, and water combined with solids. Studies of characteristics and fate of the chemicals

provide basic understanding cycle and effects on eco-system, of the organics. This course includes basic chemistry and application on actual environmental problems, with some projects with aquatic eco-systems to be dealt with.

### ESE411 Water and Wastewater Engineering [상하수도공학]
This course covers fundamental hydraulics related with pipe flows and the design of water and wastewater systems by estimating demand capacity and the optimal operations of the systems.

### ESE412 Environmental Remediation [환경복원]
The purpose of this course is to learn various physical, chemical and biological remediation methods for contaminated surface and underground environmental compartments (soil, sediment and ground water etc.). Through this course, students will learn how to determine which remediation method is most appropriate for a given contamination/case.

### ESE413 Waste Management [폐기물처리/재활용]
This course covers (1) waste generation, collection and transportation, (2) waste treatment and (3) waste recycling and recovery technologies.

### ESE414 Environmental Bioprocess [환경생물공정]
This course examines biological wastewater processes used to remove organic materials and nutrients from various wastewater. Sorption of pollutants using microorganisms and plants, aerobic and anaerobic degradation of organic contaminants, sludge treatment and the production of biofuels will be studied.

### ESE415 Environmental Toxicology [환경독성학]
Environmental toxicology deals with metabolism of hazardous chemicals and exposure assessment for human and other living organisms. During this course, the toxicity of various pollutants (persistent organic pollutants, heavy metals, pesticides and pharmaceuticals), risk assessment, such as through the use of biosensors, and regulation policies will be covered.

### ESE416 Hydraulics [수리학]
This course provides the principles and fundamental theories related to the mechanical properties of liquids based on fluid mechanics. It focuses on various engineering applications of fluids and their properties.

### ESE417 Water Treatment Modeling: Principles and Practice [수처리모델링]
This course delivers the basic principles on chemical and biological water treatments with its modeling practices. In this class, we will be using the modeling software (Comsol Multiphysics) to simulate water flow and the fate and transport of pollutants in a water treatment facility.



### ESE418 Advances in Water Quality Modeling [고급 수질 모델링]
This courses delivers advanced technologies for water quality modeling in two different ways; statistical and deterministic way. In statistical ways, we will be exploring many different modeling tools for analyzing/predicting water quality data. In deterministic way, we will study on sensitivity analysis (GSA) to make a better understanding on the relationship between parameters and model behaviors.

### ESE421~3 Special Topics in Environmental Engineering I ~ III [환경공학특론 I ~ III]
This course introduces new research topics in environmental engineering.

### ESE431 Climate Dynamics [기후역학]
This is an introductory course on the scientific background and mechanisms for the climate change and global warming. Course topics include the global energy balance of the Earth's climate system, atmospheric and oceanic energy transports and the impacts of greenhouse gases on the climate system. Limitations and uncertainty about future climate predictions will be also discussed in the class for an unbiased view to this debating phenomenon.

### ESE432 Earth Environment Numerical Analysis [지구환경전산실습]
The goals of this course are to provide a working knowledge of the basic methods of objective analysis of meteorological, oceanographic, and related data. The topics concentrate on techniques for extracting information from data directly, such as compositing, time series analysis, singular value decomposition, principal component analysis, and filtering. Both theories and application skills via a computer program such as Matlab, Fortran, Grads will be covered.

### ESE434 Climate Change Engineering [기후변화공학]
This course covers diverse topics on the causes, effects, and mitigation methods of global warming. For this purpose, we will focus on recent technologies for carbon dioxide capture and storage, clean use of fossil fuels, and new and renewable energies.

### ESE435 GIS-Based Modeling [GIS 기반 모델링]
The purpose of the course is to present geographical, temporal, environmental modeling concepts using GIS-based modeling languages and techniques. Practical laboratory experience with state-of-the-art software and hardware will be used. At the conclusion of this course, students will be able to make informed decisions about the transformation of conceptual models to mathematical models using GIS components. This course includes various modeling concepts and techniques such as spatial interpolation, suitability/capability modeling, terrain form modeling, hydrologic modeling, diffusion modeling, calibration modeling, accessibility modeling, optimization modeling, and rainfall-runoff modeling.

### ESE436 Statistics in Earth and Environmental Sciences [지구환경통계학]
Earth and Environmental Sciences often deal with huge data collected from observations and model simulations. A careful application of statistical methods to the data leads to comprehensive descriptions of geophysical phenomena or processes, validations of existing theories, and new findings of nature. This course is aimed for junior and senior students who completed the basics of statistics. The course will review the basics of statistics first, and cover the various statistical methods frequently used in the modern research, such as the regression, time series analysis, and the principal component analysis.

### ESE437 Multimedia environmental modelling [다매체환경모델링]
This course will deal with the principle of multimedia environmental fate models for persistent organic pollutants. After 2-3 weeks of lectures, students will start to make their own multimedia models using Visual Basic.

### ESE441 Special Topics in Earth Science I~III [지구환경특론 I~III]
This course introduces new research topics in earth science.

## □ Urban Infrastructure Engineering (UIE)

### UIE201 Introduction to Civil Engineering [건설공학개론]
This core course introduces the oldest interdisciplinary engineering discipline that deals with the design, construction, and maintenance of the natural and built environment. The topics covered here include structural engineering and materials, geotechnical engineering, hydraulics and hydrology. In addition, engineering mechanics with emphasis on statics will be discussed.

### UIE202 Sustainable Design [환경설계론]
This course covers the sustainable disciplines of designing natural and human environments, focusing on fashioning physical and social interventions informed by human behavior and environmental processes.

### UIE203 Introduction to Urban Planning [도시계획개론]
This course is an introduction to the methods and history of urban planning. Students will learn the methods used in various sub-fields of planning and will develop an ability to critically evaluate different techniques and approaches used within these disciplines.

### UIE204 Mechanics of Materials [재료역학]
This course introduces a branch of engineering mechanics that focuses on the internal effects of stress and strain in a solid body subjected to external loads. It covers critical fundamentals for the strengths of materials and the deformations of solid bodies, which include stress and strain; mechanical properties of materials; various external actions such as axial load, torsion, bending, and shear; stress and strain transformations; and stability problems for axially loaded members.



### UIE210 Geographic Information System [지리정보시스템]
This course covers fundamental theoretical knowledge relevant to the development and use of geographic information systems, including data models, spatial representation, and cartographic principles. The course will expose students to a wide-spread GIS software and will provide hands-on practice in database development, data retrieval, and analysis.

### UIE301 Urban Transportation Planning [교통계획]
This course discusses fundamental characteristics of the urban transportation system as a component of urban structure, methodologies for the analysis of transportation problems, planning urban transportation, and the transportation planning process.

### UIE303 Structural Analysis [구조역학]
This course is intended to provide students with the theory and application of modern structural analysis as it applies to trusses, beams, and frames. Particular emphasis is placed on developing the students' intuition to understand how structures react with applied loadings and the abilities to model and analyze civil and architectural structures.

### UIE304 Matrix Structural Analysis [매트릭스구조해석]
This course is designed to provides students with fundamental concepts in the methods of matrix structural analysis used in current practice. This covers the formation of global analysis equations, member force-deformation relations, virtual work principles, and introduction to nonlinear analysis.

### UIE305 Soil Mechanics [토질역학]
This course provides a general introduction to the mechanical properties of soils and geotechnical engineering. Soil properties, identification/ classification, groundwater within soils, and soil's behavior under applied stress are emphasized. Geotechnical design applications such as earthworks, slope stability, and foundations are also discussed.

### UIE306 Concrete Structures [콘크리트구조공학]
This course discusses the material properties, strength, behavior, and design of reinforced and prestressed concrete members subjected to moment, shear, axial, and torsional forces, and also introduces domestic and international design code provisions applying to concrete structures.

### UIE307 Properties of Concrete [콘크리트재료공학]
Concrete is one of the most important building materials. In lectures and labs, the students will learn concrete mixture proportioning and the mechanical behavior of concrete including strength, cracking, creep and shrinkage.

### UIE308 Structural Engineering Lab [구조공학실험]
This course is intended for students to conduct a series of hands-on experiments to better understand fundamental concepts in structural mechanics. The experiments include warping phenomenon, prestressed concrete, failure of truss structure, bridge building competition, etc.

### UIE309 Urban Development [도시 개발론]
This course introduces fundamental concepts and theories applied to local economic development including growth, trade, product-cycle, flexible specialization, and entrepreneurship theories.

### UIE401 Steel Structures [강구조공학]
This course introduces the design of steel structures and the behavior of steel members and their connections, when subjected to axial load, bending, shear, torsion, and combined loads. Theoretical, experimental, and practical principles for proportioning members (e.g., beams, girders, columns) and their connections (bolted, welded) are discussed. Emphasis is given to the design of plate girders, composite beams, slender columns, and eccentric shear connections.

### UIE402 Design of Structural Systems [구조시스템설계]
Theories of structural analysis are applied to urban infrastructure systems such as buildings, bridges, and underground structures. Emphasis is placed on developing the student's ability to model and analyze challenging engineering structures that may be encountered in professional practice. Classical methods are reviewed to develop a deeper understanding of fundamental sciences of engineering mechanics, and matrix structural analysis is also covered with assistance of computer-based practice.

### UIE403 Foundation Engineering [기초공학]
This course presents analysis, design, and constructive aspects of shallow and deep foundations for complex or unusual soil conditions, and earth retaining structures including retaining walls, and sheet pile bulkheads. The main objective of this course is to enable students to select the best foundation solution for different types of civil engineering problems. After completing the course, students are able to design deep and shallow foundations.

### UIE404 Infrastructure Engineering [사회기반시설공학]
This course provides an introduction to technical aspects of urban infrastructures such as tall, long-span, and large-space civil structures (schools, gymnasiums, etc.), transportation systems (bridges, roads, tunnels, subways, airports, etc.), water supply and drainage systems, waste treatment plants, electricity and gas distribution facilities, energy production plants, and so on. The students will gain a better understanding of urban infrastructure systems.

### UIE405 Urban Design [도시설계]
Introduction of fundamental urban design theory and practice will be offered in this course. Students are expected to critically look at built environment and how architecture defines and delimits physical space, and to study local and historical examples of urban design.

### UIE408 Introduction to Structural Dynamics [구조동역학개론[구조진동론]]
This introductory course is designed to provide students with fundamental concepts in structural dynamics and its application to civil engineering. The students gain a basic understanding of vibration characteristics of single and multi degree-of-freedom systems. This course includes hands-on experiments for students to better understand theories of structural dynamics in physical systems.

### UIE409 Construction Materials [건설재료공학]
The selection of proper construction materials is essential to build sustainable and resilient infrastructures. This course is designed to provide integrated knowledge of the properties of construction materials with emphasis on two major construction materials (i.e., steel and concrete) covering from elastic, plastic and fracture properties to porosity and thermal and environmental responses.

### UIE410 Special Topics in Urban infrastructure Engineering I~III [도시건설공학특론 I~III]
In this course, subject offerings of new and developing areas of knowledge in urban infrastructure engineering will be given with intention to augment the existing curriculum. See course information for topics and prerequisites.

## □ Disaster Management Engineering (DME)

### DME201 Introduction to Natural Hazards [자연재해개론]
This course provides students with the causes and effects of natural disasters such as typhoon, heavy rainfall, flooding and drought, earthquakes, volcanic eruptions, tsunami, landslides. In particular, the physical and dynamical aspects of severe and hazardous disasters are examined. Also, some cases studies will be used to investigate human, economic, and environmental consequences of destructive natural hazards.

### DME202 Man-made Disasters [인적재해]
The goal of the course is to provide a basic overview of the various types of human-induced and industrial hazards and their potential for causing disasters. The purpose is to familiarize students with the basic concepts of man-made disasters and societal vulnerability.

### DME221 Atmospheric Chemistry [대기화학]
The aim of this course is to understand the chemical composition and fate of gases and particulate matters in the atmosphere. This course focuses on various environmental issues such as acid rain, photochemical reactions, ozone depletion, and air pollutants associated with climate change.

### DME311 Probability Concepts in Engineering [공학확률]
The aim of this course is to identify and model non-deterministic engineering problems using probability theories. This course focuses on the introduction of stochastic concepts and simulation models, and their applications to real decision-making problems in various engineering disciplines including civil engineering.

### DME321 Numerical Modeling and Analysis [수치모델링 및 분석]
This course introduces the basics concept of numerical modeling and provides students with numerical methods. In addition, students have experience of numerical modeling and analysis in MATLAB.

### DME331 Disaster Management [재난관리]
The goal of the course is to provide understanding of the general principles of management and their specific applications in the field of disaster management. The objective is to identify and examine the essential and fundamental elements of disaster mitigation, preparedness, response and recovery within an inclusive management policy framework.

### DME332 Disaster Risk Analysis [재난위험성 분석[도시방재학]]
This course introduces the basic elements, processes and techniques of research utilized for description and analysis with special reference to disaster management. This course reviews how research is done and how to understand scholarly work including reading, understanding and applying studies from the field of disaster research.

### DME341 Water Resources Engineering [수자원공학]
This course introduces engineering design concepts for water resources and engineering implications, including design and analysis of systems directly concerned with use and control of water; quantitative introduction to hydrology, hydraulic engineering, and water resources planning.

### DME342 Hydrology [수문학]
This course covers the movement and distribution of water and principles of hydrologic cycle, with a particular emphasis in the areas of water management.

### DME411 Hazard Analysis for System Safety [재해분석과 시스템안전성]
The course introduces the concept of safety assessment of complex systems, such as: power plants, industrial facilities and offshore platforms. However, the same principles are also applied in computer science to software safety. The course will focus on hazards, mishap, risk, and all the different hazard analysis types. Special attention will be given to: fault tree analysis, event tree analysis, common cause failures, and failure mode and effects analysis. (Suggested courses: MTH211 Statistics).



### DME421 Weather Analysis and Prediction [날씨 분석 및 예측]
Most disaster damages in Korea are related to the high-impact weather events. This course provides how to analyze current weather using variable observation data and how to predict future weather using empirical method as well as numerical method.

### DME422 Satellite Remote Sensing [위성원격탐사]
This course deals with the basic principle of remote sensing and its applications for environmental science and engineering. Among remote sensing methods, satellite remote sensing will be focused.

### DME431 Disasters and Environmental Economics [재난 및 환경경제학]
This course covers the costs of natural and man-made disasters, the existing policy frameworks for mitigating these costs in the industrialized world, and the ways in which these policies might be adapted for the developing world.

### DME432 Vulnerability and Capacity Analysis [재해취약성 및 수용력분석]
This course provides knowledge on methods of risk identification and hazard analysis and the development of disaster management capacity of a community or region. The objective is to develop skills to assess the risk associated with a variety of scenarios and resultant vulnerability.

### DME491∼3 Special Topics in Disaster Management Engineering I∼III [재난관리공학특론 I∼III]
This undergraduate-level course is designed for subject offerings of new and developing areas in disaster & risk management engineering intended to augment the existing curriculum. See class schedule or course information for further information.

# School of Design and Human Engineering

## 1. School Introduction

UNIST school of Design and Human Engineering is unique by its joint program of Design and Human Factors, with an engineering basis. Design is nowadays the driving force behind most innovations: bringing solutions to real-world problems, but always based on a human-centered approach. Within our school you can go for an industrial design engineering program, for a human factors engineering program and for a combination of both. The industrial design engineer is a global player, able to master the whole design process, from research to ideas and from concept to production. Human factors engineers master the cognitive, physical, and physiological characteristics of human beings that are applicable to the design of devices and systems, and are able to apply the knowledge in real world design problems in order to optimize human well-being and overall system performance. Our school is pioneering a relevant curriculum that prepares design & human factors engineers for essential roles in industry today.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Industrial Design (ID)

The goal of Industrial Design track is to foster creative designers who can lead the innovative design of product and product-service systems. It provides interdisciplinary courses on design knowledge, methods and techniques across the entire product development process, including problem definition, user and market analysis, needs finding, creative idea generation, form and function development, design engineering, prototyping and business start-up. Students majoring in the ID track will play an essential role as integrative design thinkers and practitioners in future society, leading positive and innovative change in our society by employing user-centered design and scientific methods.



#### 2) Human Factors Engineering (HFE)

The goal of Human Factors Engineering track is to educate students to understand human abilities, capabilities and the human cantered design process. To achieve this goal, students learn to design experimental studies that investigate human performance, behaviour or cognition, to analyse human behavioral and physiological data, and to use these processes and data to improve the usability, safety and comfort of products, services or systems. The track provides courses covering fundamental knowledge in human factors engineering and human performance, as well as research methods. Our curriculum aims to prepare students to solve real world design problems by applying rigorous engineering methodologies.

### □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| ID | Core Required | 6 | 18 | |
| | Required | 27 | | |
| | Elective | 21 | | |
| HFE | Required | 24 | 18 | |
| | Elective | 30 | | |

## 3. Curriculum ※ Opening courses are subject to change

### □ Industrial Design (ID)

▶ Core Required: 1TR / Elective: 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ID | IID431* | Creative Design 1<br>창의디자인 1 | 3-2-2 | Prerequisite: IID302 | 1 |
| | IID432* | Creative Design 2<br>창의디자인 2 | 3-2-2 | Prerequisite: IID431 | 2 |
| Total Credit | | | 6 | | |

※ Students who choose ID track as their 1st track or double majors are required to take both 'Creative Design 1(IID431)' and 'Creative Design 2 (IID432)' before graduation.

▶ Required: 1TR / Elective: 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ID | IID201 | Design Elements and Principles<br>디자인요소와 원리 | 3-2-2 | | 1 |
| | IID202 | Product Design Fundamentals<br>제품디자인기초 | 3-2-2 | Prerequisite: IID201 | 2 |
| | IID206 | Design Visualization<br>디자인 시각화 | 3-2-2 | | 1 |
| | IID232 | 3D CAD<br>3D CAD | 3-2-2 | | 2 |
| | IID301 | Product Design Ⅰ<br>제품디자인 Ⅰ | 3-2-2 | Prerequisite: IID202 | 1 |
| | IID302 | Product Design Ⅱ<br>제품디자인 Ⅱ | 3-2-2 | Prerequisite: IID301 | 2 |
| | IID332 | UX design research methods<br>UX 디자인 연구 방법 | 3-3-0 | | 2 |
| | IID405 | Design Communication<br>디자인 커뮤니케이션 | 3-2-2 | | 2 |
| HFE | HFE202 | Human Factors Fundamentals<br>인간공학개론 | 3-3-0 | | 1 |
| **Total Credit** | | | **27** | | |

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ID | IID221 | Design History & Contexts<br>디자인 역사와 맥락 | 3-3-0 | | 1 |
| | IID231 | Design Knowledge and Skills<br>디자인 지식과 기술 | 3-3-0 | | 2 |
| | IID233 | Design for Sustainability<br>지속가능한 디자인 | 3-3-0 | | 2 |
| | IID304 | Interactive Technology<br>인터액티브 기술 | 3-3-0 | | 2 |
| | IID315 | Design Methodology<br>디자인 방법론 | 3-3-0 | | 1 |
| | IID324 | Prototyping for Design<br>디자인 프로토타이핑 | 3-3-0 | | 1 |
| | IID341 | Fundamental Electrical-Electronic Practice<br>기초전기전자실습 | 3-2-2 | | 1 |
| | IID404 | Service design fundamental<br>서비스 디자인 기초 | 3-2-2 | | 1 |
| ID | IID410 | Special Topics in IID Ⅰ<br>통합산업디자인특론 Ⅰ | 3-3-0 | | - |
| | IID420 | Special Topics in IID Ⅱ<br>통합산업디자인특론 Ⅱ | 3-3-0 | | - |
| | IID430 | Special Topics in IID Ⅲ<br>통합산업디자인특론 Ⅲ | 3-3-0 | | - |
| | IID442 | Embedded System Fundamental and Practice<br>임베디드 시스템 기초 및 실습 | 3-2-2 | | 2 |
| HFE | HFE205 | Physical Ergonomics<br>인체인간공학 | 3-3-0 | | 2 |
| | HFE206 | Cognitive Ergonomics<br>인지인간공학 | 3-3-0 | Prerequisite: HFE202 | 2 |
| | HFE301 | Experimental Design<br>실험계획법 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | HFE303 | Color Science & Engineering<br>색채과학과 공학 | 3-3-0 | | 1 |
| | HFE304 | High Touch Design<br>하이터치 디자인 | 3-2-2 | | 1 |
| | HFE305 | Physical Computing<br>피지컬 컴퓨팅 | 3-2-2 | | 1 |
| | HFE306 | Usability Engineering<br>사용성공학 | 3-3-0 | | 2 |
| | HFE308 | Sensation and Perception<br>감각과 지각 | 3-3-0 | | 2 |
| | HFE401 | Capstone Project<br>캡스톤 프로젝트 | 3-2-2 | | 1 |
| | HFE406 | Affective Engineering<br>감성공학 | 3-3-0 | | 2 |
| MAE | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| SDC | SDC202 | Computational Tools for Engineers<br>공학전산기법 | 3-3-0 | | 2 |
| | SDC405 | 3D Printing<br>3D 프린팅 | 3-3-0 | | 1 |
| MGT | MGT204 | Marketing Management<br>마케팅 관리 | 3-3-0 | | 1,2 |
| | MGT473 | Entrepreneurship and Venture Management<br>창업과 벤처 | 3-3-0 | | 1 |
| **Total Credit** | | | **81** | | |

## □ Human Factors Engineering (HFE)

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| HFE | HFE202 | Human Factors Fundamentals<br>인간공학개론 | 3-3-0 | | 1 |
| | HFE205 | Physical Ergonomics<br>인체인간공학 | 3-3-0 | | 2 |
| | HFE206 | Cognitive Ergonomics<br>인지인간공학 | 3-3-0 | Prerequisite: HFE202 | 2 |
| | HFE301 | Experimental Design<br>실험계획법 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | HFE306 | Usability Engineering<br>사용성공학 | 3-3-0 | | 2 |
| | HFE401 | Capstone Project<br>캡스톤 프로젝트 | 3-2-2 | | 1 |
| | HFE402 | Advanced Multivariate Methods and Data Mining<br>고급 다변량 분석과 데이터마이닝 | 3-3-0 | | 2 |
| SDC | SDC202 | Computational Tools for Engineers<br>공학전산기법 | 3-3-0 | | 2 |
| **Total Credit** | | | **24** | | |

### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| HFE | HFE303 | Color Science & Engineering<br>색채과학과 공학 | 3-3-0 | | 1 |
| | HFE304 | High Touch Design<br>하이터치 디자인 | 3-2-2 | | 1 |
| | HFE305 | Physical Computing<br>피지컬 컴퓨팅 | 3-2-2 | | 1 |
| | HFE308 | Sensation and Perception<br>감각과 지각 | 3-3-0 | | 2 |
| | HFE309 | Work Measurement Methods<br>작업측정 및 방법 | 3-3-0 | | 2 |
| | HFE310 | Brain and Human Behavior Ⅰ<br>- Common to humans<br>뇌와 인간행동 Ⅰ – 공통특성 | 3-3-0 | | 1 |
| | HFE311 | Brain and Human Behavior Ⅱ<br>-Difference between humans<br>뇌와 인간행동 Ⅱ – 개인차 | 3-3-0 | | 2 |
| | HFE404 | Brain-Computer Interface Design<br>뇌–컴퓨터 인터페이스 디자인 | 3-3-0 | | 1 |
| | HFE405 | Safety Engineering<br>안전공학 | 3-3-0 | | 2 |
| | HFE406 | Affective Engineering<br>감성공학 | 3-3-0 | | 2 |
| | HFE407 | Research Practicum in Human Factors<br>인간공학 연구 실무 | 3-3-0 | | 2 |
| | HFE408 | Decision Making and the Brain<br>의사결정의 신경과학 | 3-3-0 | | 1 |
| | HFE410 | Special Topics in HFE Ⅰ<br>인간공학 특론 Ⅰ | 3-3-0 | | - |
| | HFE420 | Special Topics in HFE Ⅱ<br>인간공학 특론 Ⅱ | 3-3-0 | | - |
| ID | IID201 | Design Elements and Principles<br>디자인 요소와 원리 | 3-2-2 | | 1 |
| | IID202 | Product Design Fundamentals<br>제품디자인기초 | 3-2-2 | Prerequisite: IID201 | 2 |
| | IID206 | Design Visualization<br>디자인 시각화 | 3-2-2 | | 1 |
| | IID231 | Design Knowledge and Skills<br>디자인 지식과 기술 | 3-3-0 | | 2 |
| | IID232 | 3D CAD<br>3D CAD | 3-2-2 | | 2 |
| | IID304 | Interactive Technology<br>인터액티브 기술 | 3-3-0 | | 2 |
| | IID341 | Fundamental Electrical-Electronic Practice<br>기초전기전자실습 | 3-2-2 | | 1 |
| SDC | SDC304 | Manufacturing System Design & Simulation<br>생산시스템설계 및 시뮬레이션 | 3-3-0 | | 2 |
| CSE | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| BIO | BIO305 | Principles of Neurosciences Ⅰ<br>신경과학의 원리 Ⅰ | 3-3-0 | | 1 |
| | BIO306 | Principles of Neurosciences Ⅱ<br>신경과학의 원리 Ⅱ | 3-3-0 | | 2 |
| MTH | MTH342 | Probability<br>확률론 | 3-3-0 | | 2 |
| MGE | MGE303 | Data Mining<br>데이터마이닝 | 3-3-0 | | 1 |
| MGT | MGT363 | Operations Research<br>계량경영학 | 3-3-0 | | 2 |
| | MGT413 | Game Theory<br>게임 이론 | 3-3-0 | Prerequisite: MGT211 | |
| **Total Credit** | | | **87** | | |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 | Remarks |
|---|---|---|---|---|
| ID | IID404 (Elective)<br>제품서비스시스템디자인<br>Product service system design | ⇨ | IID404 (Elective)<br>서비스 디자인 기초<br>Service design fundamental | Changing course title |
| | IID442 (Elective)<br>임베디드 시스템 이론 및 실습<br>Embedded System Principle and Practice | ⇨ | IID442 (Elective)<br>임베디드 시스템 기초 및 실습<br>Embedded System Fundamental and Practice | |
| HFE | IID401 (Required)<br>캡스톤 디자인<br>Capstone Design | ⇨ | IID401 (Required)<br>캡스톤 프로젝트<br>Capstone Project | Changing course title |





## 5. Course Descriptions

### □ Industrial Design (ID)

**IID201 Design Elements and Principles [디자인 요소와 원리]**

The objective of this course is to give an introduction into design and the role of design and the designer. People and their context are at the heart of design. Therefore, the role of human factors in design will be emphasized next to the introduction of basic elements and principles of 2D and 3D design. Students acquire understanding of and knowledge about the interaction between people, products and environments at both the individual and societal level. Through some small design projects accompanied by creativity techniques students start to learn the basic skills of problem solving.

**IID202 Product Design Fundamentals [제품디자인기초]**

This is an introduction to the fundamentals of developing three-dimensional form designs, with a focus on form appreciation and its application. Students will develop a critical understanding of and appreciation for 3D form and design aesthetic, through lectures, formative design critique sessions, peer review and discussion. Through a final terminal product design project, students learn skills ranging from solving observed design problems to constructing prototypes and mockups to communicate design intent.

**IID206 Design Visualization [디자인시각화]**

The objective of this course is to develop the ability of visualizing design ideas. Sketching and visualization is the core of learning to design. This course is set up to foster both pragmatic skills as well as an understanding of the role and use of sketching as a tool for design thinking and communication. Students learn to make perspective drawings, sketches, renderings, and simulations through hand drawing. During the second half of the course, and in parallel with this hand drawing, students use the computer to learn visualizing methods and techniques with vector and raster graphics.

**IID221 Design History & Contexts [디자인 역사와 맥락]**

This is an introductory course in design history, context of design and communication design. For the first 8 weeks, students learn about the development of design history in the context of cultural, social and technological evolvement. For the last 8 weeks, students learn about visual language and fundamental design theories for creating two-dimensional form. It involves elements of design, spatial relationships, typography and imagery. This focuses on finding creative visual solutions to communication problems using technical skills.

**IID231 Design Knowledge and Skills [디자인 지식과 기술]**

This course introduces knowledge and skills of information design with focus on the visual representation of data. Students will be introduced to the basics of information visualization where the intersection of text and image, perception and cognition, beauty and function, logic and emotion enables us to reveal what

hides behind the data and to address effective messages. In this class, students will explore conceptual and visual solutions using various computational tools, and on the creative process of organizing, visualizing and communicating information. The course will have a theoretical component, as we will cover the main rules of the discipline, and also a practical one: to design infographics and data visualizations.

### IID232 3D CAD [3D CAD]
This course aims to develop practical ability of product design utilizing 3D CAD. Students learn about how to generate and deal with 3D CAD data for product design and development. It involves the concept of integrated product design process with 3D CAD, modeling methods and techniques of master, assembly, exploded and part models for detail design, generation of engineering drawing and photo-realistic rendering for communication, and kinematic simulation and assemble-ability test of assembly model for test and refinement of design. Students also learn about producing and transferring 3D CAD data for development of physical prototypes and mass production.

### IID233 Design for Sustainability [지속가능한 디자인]
Today there is an urgent need for radical changes in our production and consumption patterns so as to delink economic growth and environmental pressure and avoid catastrophic consequences. Given the capabilities of designers to imagine and create, the following question is raised: what can designers do for a more sustainable future? In ‘Sustainability: design for future’, an introductory course to design for sustainability, we critically examine the unsustainable culture of contemporary society, and explore the roles of design for more sustainable ones. It particularly focuses on developing solutions that provoke behavior change that promotes sustainability. The course offers a systemic overview of the environmental and social challenges that we face today, a series of dialog on our unsustainable culture and behavior, ongoing efforts to change them particularly through the behavior change of consumers, and a hands-on experience to design products, services, and systems that influence behavior change towards a sustainable future.

### IID301 Product Design I [제품디자인 I]
The goal of this course is to acquire knowledge and skills in solving problems with a focus on electronics and mechanics for engineering product design. Students learn about fundamentals in electronics, control and mechanics necessary for engineering design though lectures and a series of design tasks and short projects. Through a final engineering design project, students learn skills ranging from technical problem solving with engineering approaches to constructing technologically functional prototypes with scientific and engineering rationales.

### IID302 Product Design II [제품디자인 II]
This studio course aims at developing students’ ability to design products focusing on product innovation with the consideration of user, market, technology and environment trends, as well as sustainability issues. Students apply various user-centered methods in their design project. They also investigate production processes and techniques, characteristics of materials in the stage of developing product specification.



Through a final product design project, students develop an innovative product concept that satisfies user experience, market needs and sustainability requirements.

### IID304 Interactive Technology [인터액티브 기술]
In this class, students will learn ways to design and implement one highly-finished interactive prototype by going through the iterative prototyping process of the design concepts they have generated. Students will discuss and practice how to apply technologies from the perspective of design; specifically, they will learn essential engineering skills comprising physical computing skills, and programming skills (using Arduino & Processing) for the hardware and software development of their prototypes. Along with this, students will conduct ideation of their designs from the initial phase of the course until finalization, in order to generate one novel and creative interactive product idea. Ideation will be done based on engineering skill practice, technology trend research and user needs exploration.

### IID315 Design Methodology [디자인 방법론]
The objective of this course is to acquire a deeper understanding of designing as a problem solving activity. Student investigate the definitions and characteristics of design and design problem, and learn about design process. They learn design process from two perspectives; an individual’s cognitive process for problem solving with a focus of creativity and a systematic and collaborative product development process in organization. Lectures, discussions and assignments help the students to develop the ability to think critically about the design process and methods, and thus to improve their own design processes.

### IID324 Prototyping for Design [디자인 프로토타이핑]
The course aims to foster an understanding of the role and use of design prototyping as method for design ideation, development and communication. To achieve this the course will cover prototyping principles and strategies as related to design process, and appropriate skills, strategies and approaches for the application of the prototyping method during industrial design.

### IID332 UX design research methods [UX 디자인 연구 방법]
This course aims to acquire the ability to select and apply appropriate design methods, techniques and tools throughout the product design process. Students learn about various design research approaches and strategies to tackle design challenges. These research methods are typical for each stage of the design process. It involves user research methods for internally and externally analyzing the company and identifying user needs, for example by way of survey, interviews and context mapping. In the concept development stage research involves observation techniques in confronting users with early sketches and models. Usability testing is part of the prototyping stage finally followed by market research. Both lectures and studio work are part of this course.

### IID341 Fundamental Electrical–Electronic Practice [기초전기전자실습]
In this class, students can learn how to deal some tools and instruments which are basic but very important to develop an electrical or electronic product. Through this class, students can understand the physical meaning of an electrical/electronic signal as well as an electrical circuit diagram. The method of how to utilize the basic electrical components, such as a resistor, a capacitor or a diode, will be dealt. Students can also learn and practice how to handle a power supply, a soldering iron, a cable, a multimeter, and an oscilloscope. Eventually, they will have abilities to implement their own product with less mistakes, as they have knowledge and experience about handling electrical/electronic tools and instruments.

### IID404 Service design fundamental [서비스 디자인 기초]
A course that provides understanding fundamentals of service design, various service design methods, a hands-on experience and creative thinking perspective on service design. You will be conducting design research, generate ideas, creating service concept, map service blueprint for a project. Service design research can be conducted in many different ways, depending on the purpose of the project. Often major purpose could be generating useful inspiration for design, or understanding context to create solid empathic approach. Service design research also need to be designed. Student will learn service design methods. However, it's very critical ability that scoping and reformulation of research methods and have a good mapping between design research question and requirement. Goal of the course is go critically beyond (at the same time respect) traditional methodologies with great design flexibility on the fly.

### IID405 Design Communication [디자인 커뮤니케이션]
The objective of this course is to train communication skills and techniques and explore career perspective. For the early half of the semester, emphasis is given to portfolio design and self-promotion. Students learn about the relationships between communication and design practice with industry. From the oral presentation of design ideas to the use of visualization methods and prototypes of various levels of detail and fidelity, students will develop their ability to effectively communicate their design intentions to a variety of stake holders. For the last half of the semester, students investigate professional areas related to design. They develop a greater understanding of career in or related to design through searching for potential jobs and interviewing professionals in industry.

### IID410, 420, 430 Special Topics in IID I, II, III [통합산업디자인특론 I, II, III]
In these courses contemporary topics in various areas related to Industrial Design will be covered. Topic selection will be made based upon special interests.

### IID431 Creative Design 1 [창의디자인 1]
This design project course aims to explore the design process in a company context with an initial focus on the fuzzy front-end, leading to a search for opportunities for new product development in this particular company context. Taking the company's expertise, product portfolio and production capacity into account, the search should deliver various new 'search fields' with product ideas for every field. The most promising product idea will be chosen to elaborate into a model. Students are required to utilize and integrate prior knowledge and skills acquired in previous semesters in order to identify problems, and conceive and propose a novel idea or design concept. Final outcomes include concept visualization, a design model, a report and a presentation which includes a two-minutes video pitch. The course runs through team teaching among ID professors.

### IID432 Creative Design 2 [창의디자인 2]
This is the terminal degree project course. It aims to enhance and exhibit students' ability of product design in a holistic and integrative way by executing a product development project in a company context. Students go through an internal and external analysis of the company, problem definition, conceptualization, developing design specification, detail design, prototyping, testing, marketing, and public presentation. The course runs through team teaching among ID professors.

### IID442 Embedded System Fundamental and Practice [임베디드 시스템 기초 및 실습]
In this lecture, various electrical-electronic sensors and digital control techniques are covered as aspects of an embedded system. Covered topics include expandable ARM processor-based single board controller, firmware development, digital-analog interface, and various I/O devices. Hands-on design experiments are performed to ensure students' understanding their own systems. Through this lecture, students can develop their abilities to implements diverse interactive products.

## □ Human Factors Engineering (HFE)

### HFE202 Human Factors Fundamentals [인간공학개론]
This course surveys human factors engineering emphasizing the systems approach to workplace and machine design. It includes a discussion of basic human factors research and design methods, visual processes and design methods, selection of statistical techniques for application to human factors data, visual and auditory processes, display and control design, and effects of environmental stressors on humans.

### HFE205 Physical Ergonomics [인체인간공학]
This course provides students with a working knowledge of key areas of physical ergonomics. These include: the physiology of the human musculoskeletal system; work capacity; occupational biomechanics; and digital human movement modeling. This knowledge will be applied to problems in product and environment design.

### HFE206 Cognitive Ergonomics [인지인간공학]
This course studies how products and systems can be improved by understanding human cognitive characteristics and applying fundamental theories of psychology to design and engineering problems.

### HFE301 Experimental Design [실험계획법]

The course describes procedures for designing, conducting and analyzing experiments efficiently and effectively. It includes the fundamentals of research, experimental design alternatives, fitting and testing statistical models, and data interpretation and presentation. Both design and statistical issues will be discussed and computer software packages to implement the methods presented will be illustrated extensively.

### HFE303 Color Science & Engineering [색채과학과 공학]

This course deals with the human vision, fundamentals of color science, and its applications. Human visual system, psychophysics, CIE colorimetry, color appearance, and engineering issues related to color imaging systems such as displays or camera will be taught. Student will conduct a project related to the human visual perception and application system.

### HFE304 High Touch Design [하이터치 디자인]

High Touch Design is a process that tries to develop a user friendly, compatible and aesthetic product based upon human factors and psychophysiological knowledge. Variables in High Touch design include combinatorial sets of design variables among (Human x Product x Task x Environment x Culture). A hierarchical analysis of complex variables, matrix analysis of integrated variables, structural analogy in creative design will be covered. The term project will be assigned to create a non-existing product.

### HFE305 Physical Computing [피지컬 컴퓨팅]

This course introduces students to the area of physical computing - the use of sensors and actuators to sense and respond to natural human actions and activities. This course is about creating systems and products that bridge the gap between the physical and digital worlds by providing the knowledge, skills, examples and experience to realize novel and compelling forms of physical-digital connection. It takes the form of a studio course supplemented by a series of tutorials covering basic technical material. Students will develop skills in conceiving, designing, prototyping and critiquing systems that realize physical-digital interaction design.

### HFE306 Usability Engineering [사용성공학]

In the context of the design of interactive computer systems (e.g. Human-Computer Interaction), this course deals with definition of usability, what metrics can be used to measure and quantify it and what techniques and methods can be used to improve and achieve it. Course material will be delivered by lecture and student assessment is via exams and a single full-semester class project. Individual classes will also be devoted to supporting and critiquing project work.

### HFE308 Sensation and Perception [감각과 지각]

This course provides an overview of contemporary theory and research in perception, including related computational and biological issues along with their applications. We learn how human beings acquire, process and utilize information about objects and events in the environment, covering vision, audition, taste, smell, touch, and multi-sensory integration.



### HFE309 Work Measurement Methods [작업측정 및 방법]

This course aims to introduce methods for assessing and improving human performance and manufacturing productivity. Topics studied include basic industrial engineering tools, work measurement procedures, data acquisition, analysis and applications, performance evaluation and appraisal, and learning curve etc.

### HFE310 Brain and Human Behavior Ⅰ – Common to humans [뇌와 인간행동 Ⅰ –공통특성]

This course will introduce the nature of human behavior. Students will learn how the brain works and how the researchers find it. Students will understand the behavior of other people as well as their own. We will deal with various basic topics in psychology such as brain biology, perception and memory.

### HFE311 Brain and Human Behavior Ⅱ – Difference between humans [뇌와 인간행동 Ⅱ –개인차]

This course will introduce the nature of human behavior. Students will learn how the brain works and how the researchers find it. Students will understand the behavior of other people as well as their own. We will deal with various topics in psychology which explains the difference between humans, such as intelligence, personality and mental illness.

### HFE401 Capstone Project [캡스톤 프로젝트]

The objective of this course is to apply knowledge of design and human factors to the design of a product, service or system. Integration of research on human factors into the process will be required. Students work in teams to design and develop functional prototypes (hardware/software), computer simulations, and/or professional reports with real applications. At the end of the semester, students showcase their efforts at the school exhibition.

### HFE402 Advanced Multivariate Methods and Data Mining [고급 다변량 분석과 데이터마이닝]

This course offers students an opportunity to study the methods to analyze human and other types of data on a basis of statistical inference. Specifically, this course deals with multivariate data and associated statistical methods and concepts. Also, this course aims to have students learn how to infer and extract key information from real-world data. Many essential machine learning methods and their profound concepts will be discussed during the class for multivariate data mining. Last but not the least, this course emphasizes hands-on experiences of data analysis using computer programming, for instance Matlab, to help students apply the learned knowledge to research.

### HFE404 Brain–Computer Interface Design [뇌–컴퓨터 인터페이스 디자인]

This course introduces the fundamentals of Brain-Computer Interface (BCI). Students will learn how to sense, process and use signals captured from the brain to develop functional interfaces between the human brain and external devices.

### HFE405 Safety Engineering [안전공학]

This course provides students with a general understanding of occupational and systems safety. Students will learn how to apply system safety methodologies to workplace design evaluation, accident analysis and consumer product design, as well as gain an understanding of human error analysis, accident potential recognition, occupational safety and health legislation, and safety considerations in consumer product design.

### HFE406 Affective Engineering [감성공학]

Translation of human affections into design features is the objective of Affective Engineering. This course focuses upon the techniques and relevant theories of Affective Engineering. Exemplar products and studies will be introduced to show that Affective Engineering plays a role in designing more attractive products.

### HFE407 Research Practicum in Human Factors [인간공학 연구 실무]

This course deals with special topics in ACE (Affect, Cognition, and/or Ergonomics). The instructor will introduce basics, advances, and recent activities in ACE-related research areas. Students will present and criticize journal papers from these areas. For the team-based project, each team will define their research topic, design experiments, run pilot/main experiments, and write a professional research report.

### HFE408 Decision making and the Brain [의사결정의 신경과학]

This course introduces the field of Neuroeconomics, and covers selected topics in interdisciplinary research approach that focuses on the brain's mechanisms for decision evaluation and choice. We will approach issues from multiple perspectives, drawing on theoretical, behavioral, and neural data from economics, psychology, and neurobiology. Major topics include: decision under risk, value computation, social preference, game theory, and social interaction. By the end of this course, you will have better understanding of the computational and neuroscientific mechanisms how the brain evaluates and makes choices. No formal prerequisites are needed, and we will cover necessary background as it arises.

### HFE410, 420 Special Topics in HFE I, II [인간공학 특론 I, II]

In these courses contemporary topics in various areas related to Human and Systems Engineering will be covered. Topic selection will be made based upon special interests.





# School of Materials Science and Engineering

## 1. School Introduction

The School of Materials Science and Engineering is an interdisciplinary field which emphasizes the study of processing-structure-property relations in materials. In order to develop new materials and find their applications, it is important to understand the fundamental relationship between the structure, processing and properties. The school of Materials Science and Engineering covers conventional materials to most advanced materials including nano materials and beyond.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Advanced Materials Science (AMS)

Students in Advanced Materials Science (AMS) track will learn how the structure is controlled during the manufacturing process by various chemical, thermal, mechanical, electrical and other treatments. AMS track is directed towards understanding of various materials such as metals, ceramics, semiconductors, polymers and hybrid materials at both macroscopic and microscopic scale. Advanced materials in this area include structural materials covering cars, aerospace and ships, electronic materials covering semiconductors and displays, and energy materials covering solar cells, fuel cells, batteries and supercapacitors. We expect the students to play a key role in a wide range of modern science, technologies and industrial fields based on the knowledge of materials science and engineering.

#### 2) Semiconductor Materials Engineering (SE)

Semiconductor Materials Engineering (SE) track is a technologically emerging field of materials science and engineering emphasized on semiconductor-related materials, processes, devices, and applications. Students in SE track will also have a wide range of opportunities to learn and practice the core knowledge of new applications such as display technologies and artificial intelligence, as well as the different types of semiconductor memory and logic devices. To do this, students will be trained to acquire knowledge about basic solid-state physics and theory, the realization of semiconductor technologies through various

methodologies, the transfer of researched and developed technologies, and how to apply them into various industrial applications. Students who graduate from SE track are expected to play an important role in the materials, equipment and manufacturing fields of semiconductors and displays, as well as related new industries such as big data, the Internet of Things and artificial intelligence.

### □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| AMS | Required | 15 | 3 | |
| | Elective | 39 | 15 | |
| SE | Required | 15 | 3 | |
| | Elective | 39 | 15 | |

## 3. Curriculum ※ Opening courses are subject to change

### □ Advanced Materials Science (AMS)

▶ Core Required (Mandatory for both 1TR, 2TR)

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| AMS | AMS202 | Introduction to Materials Science and Engineering<br>재료공학개론 | 3-3-0 | Identical: SCM202, ENE216 | 1 |
| Total Credit | | | 3 | | |

▶ Required (Only for 1TR students)

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| AMS | AMS203 | Physical Chemistry I: Thermodynamics<br>재료물리화학I: 열역학 | 3-3-0 | Identical: SCM203 | 1 |
| | AMS230 | Introduction to Crystallography<br>결정학개론 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 2 |
| | AMS290 | Introduction to Computational Materials Science<br>전산재료과학개론 | 3-3-0 | | 2 |
| | AMS300 | Materials Lab<br>재료실험 | 3-1-4 | | 2 |
| Total Credit | | | 12 | | |

*1TR students MUST take above 4 courses.



▶ Selective Required: Only AMS as the 1st track and SE as the 2nd track. Others: Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| AMS | AMS210 | Defects in Crystals<br>결정결함론 | 3-3-0 | | 2 |
| | AMS250 | Modern Physics of Materials<br>재료현대물리 | 3-3-0 | | 2 |
| | AMS270 | Introduction to Polymer Materials<br>고분자재료개론 | 3-3-0 | Identical: ACE351/ ENE226/CHM372 | 2 |
| | AMS311 | Introduction to Metallic Materials<br>금속재료개론 | 3-3-0 | | 2 |
| | AMS312 | Phase Transformations in Materials<br>재료상변태 | 3-3-0 | | 1 |
| | AMS313 | Mechanical Behavior of Materials<br>재료의기계적거동 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 1 |
| | AMS350 | Solid State Physics of Materials<br>재료고체물리 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 2 |
| Total Credit | | | 21 | | |

* Students majoring AMS as the 1st track and SE as the 2nd track should choose 1 from 7 courses above as Core required.

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| AMS | AMS353 | Surface Science of Materials<br>재료표면과학 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 2 |
| | AMS354 | Physical Chemistry of Materials Ⅱ:<br>Reaction Engineering<br>재료물리화학 Ⅱ: 반응공학 | 3-3-0 | | 1 |
| | AMS360 | Bio-inspired Materials Science<br>바이오소재과학 | 3-3-0 | Identical: BME435 | 2 |
| | AMS372 | Polymer Physics<br>고분자 물리 | 3-3-0 | | 2 |
| | AMS401 | Transmission Electron Microscopy<br>전자현미경학 | 3-3-0 | | 1 |
| | AMS405 | Introduction to Crystal Growth<br>결정성장개론 | 3-3-0 | | 1 |
| | AMS431 | Magnetic Properties of Materials<br>재료의 자기적 성질 | 3-3-0 | | 1 |
| | AMS432 | Piezoelectric Materials<br>압전재료 | 3-3-0 | | 1 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| AMS | AMS433 | Physical Ceramics<br>세라믹 물성학 | 3-3-0 | | 2 |
| | AMS454 | Nano-Materials Reliability<br>나노소재신뢰성 | 3-3-0 | | 1 |
| | AMS471 | Polymer Composites<br>고분자 복합재료 | 3-3-0 | | 2 |
| | AMS491 | Special Topics in Advanced Materials Science Ⅰ<br>첨단소재과학특론 Ⅰ | 3-3-0 | | - |
| | AMS492 | Special Topics in Advanced Materials Science Ⅱ<br>첨단소재과학특론 Ⅱ | 3-3-0 | | - |
| | AMS493 | Special Topics in Advanced Materials Science Ⅲ<br>첨단소재과학특론 Ⅲ | 3-3-0 | | - |
| | AMS494 | Special Topics in Advanced Materials Science Ⅳ<br>첨단소재과학특론 Ⅳ | 3-3-0 | | - |
| SE | SCM204 | Electromagnetics<br>전자기학 | 3-3-0 | | 2 |
| | SCM251 | Introduction to Nanomaterials<br>나노재료개론 | 3-3-0 | | 2 |
| | SCM301 | Semiconductor Lab<br>반도체실험 | 3-1-4 | - | 1 |
| | SCM321 | Instrumental Analysis for Materials<br>재료분석기기 | 3-3-0 | | 1 |
| | SCM330 | Nano-Electroceramics<br>나노전자세라믹스 | 3-3-0 | | 2 |
| | SCM351 | Thin Film Technology<br>박막공학 | 3-3-0 | | 1 |
| | SCM354 | Introduction to Semiconductor<br>반도체개론 | 3-3-0 | | 1 |
| | SCM355 | Nano-energy Materials<br>나노에너지재료 | 3-3-0 | | 1 |
| | SCM356 | Nanophotonics<br>나노포토닉스 | 3-3-0 | | 2 |
| | SCM452 | Semiconducting Devices<br>반도체소자 | 3-3-0 | | 1 |
| | SCM453 | Semiconductor Processing<br>반도체공정 | 3-3-0 | | 2 |
| | SCM455 | Display Engineering<br>디스플레이공학 | 3-3-0 | | 1 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SE | SCM472 | Flexible Electronics<br>유연전자소자 | 3-3-0 | | 1 |
| | SCM491 | Special Topics in Semiconductor Materials Engineering Ⅰ<br>반도체재료공학특론 Ⅰ | 3-3-0 | | - |
| | SCM492 | Special Topics in Semiconductor Materials Engineering Ⅱ<br>반도체재료공학특론 Ⅱ | 3-3-0 | | - |
| | SCM493 | Special Topics in Semiconductor Materials Engineering Ⅲ<br>반도체재료공학특론 Ⅲ | 3-3-0 | | - |
| | SCM494 | Special Topics in Semiconductor Materials Engineering Ⅳ<br>반도체재료공학특론 Ⅳ | 3-3-0 | | - |
| MAE | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 2 |
| | MEN431 | Introduction to Plastic Deformation<br>소성학개론 | 3-3-0 | Prerequisite: MEN231 | 1 |
| ENE | ENE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ACE312 | 2 |
| PHY | PHY201 | Classical Mechanics<br>고전역학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY301 | Quantum Physics Ⅰ<br>양자물리학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY303 | Thermal and Statistical Physics<br>열 및 통계물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| CHM | CHM211 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | Identical: ACE201, ENE211 | 1 |
| | CHM291 | Analytical Chemistry Ⅰ<br>분석화학 Ⅰ | 3-3-0 | Identical: ENE213 | 1 |
| | CHM321 | Biochemistry Ⅰ<br>생화학 Ⅰ | 3-3-0 | Identical: BIO211 | 1 |
| | CHM351 | Inorganic Chemistry Ⅰ<br>무기화학 Ⅰ | 3-3-0 | Identical: ACE304, ENE311 | 1 |
| BIO | BIO201 | Molecular Biology<br>분자생물학 | 3-3-0 | | 2 |
| | BIO211 | Biochemistry Ⅰ<br>생화학 Ⅰ | 3-3-0 | Identical: CHM321 | 1 |
| BME | BME211 | Intro to Biomedical Engineering<br>생명공학개론 | 3-3-0 | | 1 |
| | | **Total Credit** | **144** | | |

## □ Semiconductor Materials Engineering (SE)

### ▶ Core Required (Mandatory for both 1TR, 2TR)

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SE | SCM202 | Introduction to Materials Science and Engineering<br>재료공학개론 | 3-3-0 | Identical: AMS202, ENE216 | 1 |
| **Total Credit** | | | **3** | | |

### ▶ Required (Only for 1TR students)

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SE | SCM203 | Physical Chemistry Ⅰ : Thermodynamics<br>재료물리화학Ⅰ :열역학 | 3-3-0 | Identical: AMS203 | 1 |
| | SCM204 | Electromagnetics<br>전자기학 | 3-3-0 | | 2 |
| | SCM301 | Semiconductor Lab<br>반도체실험 | 3-1-4 | | 2 |
| | SCM354 | Introduction to Semiconductor<br>반도체개론 | 3-3-0 | | 1 |
| **Total Credit** | | | **12** | | |

*1TR students MUST take above 4 courses.

### ▶ Selective Required: Only SE as the 1st track and AMS as the 2nd track. Others: Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SE | SCM250 | Modern Physics of Materials<br>재료현대물리 | 3-3-0 | | 2 |
| | SCM251 | Introduction to Nanomaterials<br>나노재료개론 | 3-3-0 | | 2 |
| | SCM290 | Introduction to Computational Materials Science<br>전산재료과학개론 | 3-3-0 | | 2 |
| | SCM313 | Mechanical Behavior of Materials<br>재료의기계적거동 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 1 |
| | SCM350 | Solid State Physics of Materials<br>재료고체물리 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 2 |
| **Total Credit** | | | **15** | | |

* Students majoring SE as the 1st track and AMS as the 2nd track should choose 1 course from 5 courses above as Core required.



### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SE | SCM321 | Instrumental Analysis for Materials<br>재료분석기기 | 3-3-0 | | 1 |
| | SCM330 | Nano-Electroceramics<br>나노전자세라믹스 | 3-3-0 | | 2 |
| | SCM351 | Thin Film Technology<br>박막공학 | 3-3-0 | | 1 |
| | SCM355 | Nano-energy Materials<br>나노에너지재료 | 3-3-0 | | 1 |
| | SCM356 | Nanophotonics<br>나노포토닉스 | 3-3-0 | | 2 |
| | SCM452 | Semiconducting Devices<br>반도체소자 | 3-3-0 | | 1 |
| | SCM453 | Semiconductor Processing<br>반도체공정 | 3-3-0 | | 2 |
| | SCM455 | Display Engineering<br>디스플레이공학 | 3-3-0 | | 1 |
| | SCM472 | Flexible Electronics<br>유연전자소자 | 3-3-0 | | 1 |
| | SCM491 | Special Topics in Semiconductor Materials Engineering Ⅰ<br>반도체재료공학특론 Ⅰ | 3-3-0 | | - |
| | SCM492 | Special Topics in Semiconductor Materials Engineering Ⅱ<br>반도체재료공학특론 Ⅱ | 3-3-0 | | - |
| | SCM493 | Special Topics in Semiconductor Materials Engineering Ⅲ<br>반도체재료공학특론 Ⅲ | 3-3-0 | | - |
| | SCM494 | Special Topics in Semiconductor Materials Engineering Ⅳ<br>반도체재료공학특론 Ⅳ | 3-3-0 | | - |
| AMS | AMS210 | Defects in Crystals<br>결정결함론 | 3-3-0 | | 2 |
| | AMS230 | Introduction to Crystallography<br>결정학개론 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 2 |
| | AMS270 | Introduction to Polymer Materials<br>고분자재료개론 | 3-3-0 | Identical: ACE351/ ENE226/CHM372 | 2 |
| | AMS300 | Materials Lab<br>재료실험 | 3-1-4 | | 2 |
| | AMS311 | Introduction to Metallic Materials<br>금속재료개론 | 3-3-0 | | 2 |
| | AMS312 | Phase Transformations in Materials<br>재료상변태 | 3-3-0 | | 1 |
| | AMS350 | Solid State Physics of Materials<br>재료고체물리 | 3-3-0 | Prerequisite: AMS202 or SE202 | 2 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| AMS | AMS353 | Surface Science of Materials<br>재료표면과학 | 3-3-0 | Prerequisite: AMS202 or SE202 | 2 |
| | AMS355 | Physical Chemistry of Materials Ⅱ :<br>Reaction Engineering<br>재료물리화학 Ⅱ : 반응공학 | 3-3-0 | | 1 |
| | AMS360 | Bio-inspired Materials Science<br>바이오소재과학 | 3-3-0 | Identical: BME435 | 2 |
| | AMS372 | Polymer Physics<br>고분자물리 | 3-3-0 | | 2 |
| | AMS401 | Transmission Electron Microscopy<br>전자현미경학 | 3-3-0 | | 1 |
| | AMS405 | Introduction to Crystal Growth<br>결정성장개론 | 3-3-0 | | 1 |
| | AMS431 | Magnetic Properties of Materials<br>재료의 자기적 성질 | 3-3-0 | | 1 |
| | AMS432 | Piezoelectric Materials<br>압전재료 | 3-3-0 | | 1 |
| | AMS433 | Physical Ceramics<br>세라믹 물성학 | 3-3-0 | | 2 |
| | AMS454 | Nano-Materials Reliability<br>나노소재신뢰성 | 3-3-0 | | 1 |
| | AMS471 | Polymer Composites<br>고분자 복합재료 | 3-3-0 | | 2 |
| | AMS491 | Special Topics in<br>Advanced Materials Science Ⅰ<br>신소재과학특론 Ⅰ | 3-3-0 | | - |
| | AMS492 | Special Topics in<br>Advanced Materials Science Ⅱ<br>신소재과학특론 Ⅱ | 3-3-0 | | - |
| | AMS493 | Special Topics in<br>Advanced Materials Science Ⅲ<br>신소재과학특론 Ⅲ | 3-3-0 | | - |
| | AMS494 | Special Topics in<br>Advanced Materials Science Ⅳ<br>신소재과학특론 Ⅳ | 3-3-0 | | - |
| MAE | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 2 |
| | MEN431 | Introduction to Plastic Deformation<br>소성학개론 | 3-3-0 | Prerequisite: MEN231 | 1 |
| ENE | ENE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ACE312 | 2 |
| EE | EE201 | Basic Circuit Theory<br>회로이론 | 3-3-0 | | 2 |
| EE | EE301 | Microelectronics Ⅰ<br>전자회로 Ⅰ | 3-3-0 | Prerequisite: EE201 | 1 |
| | EE431 | Semiconductor VLSI Devices Engineering<br>반도체집적소자공학 | 3-3-0 | | 2 |
| PHY | PHY201 | Classical Mechanics<br>고전역학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY301 | Quantum Physics Ⅰ<br>양자물리학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY303 | Thermal and Statistical Physics<br>열 및 통계물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| | PHY407 | Semiconductor and<br>Precision Measurement Physics<br>반도체 및 계측 물리학 | 3-2-2 | | 1 |
| CHEM | CHM211 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | Identical: ACE201, ENE211 | 1 |
| | CHM351 | Inorganic Chemistry Ⅰ<br>무기화학 Ⅰ | 3-3-0 | Identical: ACE304, ENE311 | 1 |
| BME | BME211 | Intro to Biomedical Engineering<br>생명공학개론 | 3-3-0 | | 1 |
| | | **Total Credit** | **147** | | |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| SE (old-NME) | AMS350 (Elective)<br>Solid State Physics of Materials<br>재료고체물리 | ⇨ | SCM350 (Required)<br>Solid State Physics of Materials<br>재료고체물리 |
| | AMS390 (Elective)<br>Introduction to Computational Materials<br>전산재료과학개론 | ⇨ | SCM290 (Required)<br>Introduction to Computational Materials<br>전산재료과학개론 |
| AMS | AMS311 (Elective)<br>Introduction to Metallic Materials<br>금속재료개론 | ⇨ | AMS311 (Required)<br>Introduction to Metallic Materials<br>금속재료개론 |
| | NME270 (Elective)<br>Introduction to Polymer Materials<br>고분자재료개론 | ⇨ | AMS270 (Required)<br>Introduction to Polymer Materials<br>고분자재료개론 |
| | NME350 (Elective)<br>Modern Physics of Materials<br>재료현대물리 | ⇨ | AMS250 (Required)<br>Modern Physics of Materials<br>재료현대물리 |

## 5. Course Descriptions

### □ Advanced Materials Science (AMS)

#### AMS202 Introduction to Materials Science and Engineering [재료공학개론]

The need for new materials is now increasing as both the mechanical and (opto-)electronic devices become small, light, and integrated. The understanding of basic structures and properties of materials in the areas of metals, semiconductors, ceramics, and polymers is essential to develop new materials. The main background of this course is educating the fundamental sciences and techniques associated with various structures, properties, and engineering process. This lecture is to help students understand the relationship between microstructures of materials and physical (mechanical, electrical, magnetic, optical) and chemical properties.

#### AMS203 Physical Chemistry I: Thermodynamics of Materials [재료물리화학I: 열역학]

This course is one of the fundamental courses in Materials Science and Engineering as a topic in the field of Applied Physical Chemistry, and is focused on the understanding of material properties and fundamental phenomena related to material processes. Specific topics will include gas state properties and structures, thermodynamic laws, and equilibrium state.

#### AMS210 Defects in Crystals [결정결함론]

As well known in the materials science field, the properties of materials are strongly influenced by the population of intrinsic and extrinsic defects in crystals. This course contains three main sections: point defects (zero-dimensional defects), dislocations (one-dimensional defects), and planar defects (two-dimensional defects). The properties, characteristics, kinetics, energetics and thermodynamics of those defects in crystals will be discussed.

#### AMS230 Introduction to Crystallography [결정학개론]

This course covers the derivation of symmetry theory; lattices, point groups, space groups, and isotropic and anisotropic properties of crystals. This course also covers the principles and applications of x-ray diffraction and electron diffraction to identify cystal structure.

#### AMS250 Modern Physics of Materials [재료현대물리]

This course design to introduce very basics on modern physics including relativity, quantum mechanics for materials science and engineering. The goal of this course is to understand core concepts of modern physics and to learn how to apply them to materials research.

#### AMS270 Introduction to Polymer Materials [고분자재료개론]

Introduction to Polymer Materials course is designed for undergraduate students to understand the basic concept of polymer materials (principles of polymer, polymer synthesis, properties and applications).



#### AMS290 Introduction to Computational Materials Science [전산재료과학개론]

In this class, a couple of basic numerical analyses will be discussed and the hands- on experience of those concepts will be practiced using C program (or MATLAB, if needed). The first main topics include C basics, including basic expressions, variables, matrices, arrays, vectors, flow control, functions, string treatment, structure, i/o handling, and etc. After that, a few of the basic concepts on random numbers will be discussed because the second topic of the class, the mesoscopic computational materials science methods for microstructural evolution, such as the Monte Carlo simulations, and Cellular Automata, will utilize the random number generation modules.

#### AMS300 Materials Lab [재료실험]

This course provides an experimental introduction to key concepts in materials such as metals, ceramics, and semiconductors and the relationships among structure, properties and performance will be examined.

#### AMS311 Introduction to Metallic Materials [금속재료개론]

This course aims to basically understand the microstructure and mechanical properties of metallic materials, which include ferrous and non-ferrous metals and alloys. Dislocation, phase transformation, and strengthening mechanisms will be covered in this course. The relationship between microstructure and mechanical properties in metallic materials will also be discussed.

#### AMS312 Phase Transformations in Materials [재료상변태]

The state of matter is dependent upon temperature, thermal history, and other variables. In this course the science of structural transitions is treated, with the purpose in mind of utilizing them for producing materials with superior properties. The subjects covered include the methods of structural analysis, solidification, solid state transformation, and order-disorder transition.

#### AMS313 Mechanical Behavior of Materials [재료의 기계적거동]

This course explores the phenomenology of mechanical behavior of materials at the macroscopic level and the relationship of mechanical behavior to material structure and mechanisms of deformation and failure. Topics covered include elasticity, viscoelasticity, plasticity, creep, fracture, and fatigue. Case studies and examples are drawn from structural and functional applications that include a variety of material classes: metals, ceramics, polymers, thin films, composites, and cellular materials.

#### AMS350 Solid State Physics of Materials [재료고체물리]

This course will provide fundamental knowledges of physics of solids on the basis of quantum and statistical mechanics. Topics include crystal structures, reciprocal lattice, x-ray diffraction, lattice dynamics, solid state thermodynamics, free and nearly free electron models, kinetic theory and transport, energy band theory, metal/semiconductor/insulator, and semiconductor physics and devices.

### AMS353 Surface Science of Materials [재료표면과학]

In low dimensional materials, the surfaces plays an important role in governing the material's whole property. The physical and chemical properties of the surface is different from that of bulk materials, and these novel properties of the surface can be used to develop new functional materials. This course covers the structure of the surface, the physical, chemical, and electronic properties of the surface, the physics and chemistry behind surface phenomena.

### AMS355 Physical Chemistry of Materials Ⅱ : Reaction Engineering [재료물리화학 Ⅱ: 반응공학]

This course is designed to extend the concepts and knowledge learned from subject AMS203 Thermodynamics of materials and provide fundamental knowledge of thermodynamics for materials scientists and engineers. It covers phase equilibrium, calculation of heat capacitance, and the relation between free energy and phase diagram.

### AMS360 Bio-inspired Materials Science [바이오소재과학]

The objectives of the course are to offer an overview of bio-inspired materials, bio-inspired intelligent structures, and bio-inspired morphing structures through advanced understanding of material properties, design and structural behavior at different levels (material, element, structural and system levels). We will discuss emerging applications for bio-inspired structures and the impact of bio-inspired and bio-derived ideas on nano- and related technologies.

### AMS372 Polymer Physics [고분자물리]

This course presents the various physical properties (e.g. mechanical, optical, and transport) of polymers with respect to the underlying physical chemistry of polymers in melt, solution, and solid state. Topics include conformation and molecular dimensions of polymer chains; an examination of the structure and thermodynamics of glassy, crystalline, and rubbery elastic states of polymers; liquid crystallinity, microphase separation, multi-component polymer system.

### AMS401 Transmission Electron Microscopy [전자현미경학]

Theoretical and practical aspects of conventional and high-resolution transmission electron microscopy and related techniques will be covered; Imaging theory, electron diffraction theory and spectroscopy such as energy dispersive x-ray spectroscopy and electron energy loss spectroscopy.

### AMS405 Introduction to Crystal Growth [결정성장개론]

This course is designed to study the basics of crystal growth. The course includes following weekly schedule; Crystal ambient phase equilibrium, Nucleation, Classical crystal growth, Nonclassical crystal growth.



### AMS431 Magnetic Properties of Materials [재료의 자기적 성질]

Magnetism is one of the most actively studied research area in modern science and technology. It is a collective phenomenon, involving the mutual cooperation of enormous numbers of particles. This course introduces elementary magnetostatics and atomic origins of magnetism. Students will learn properties of ferro-, para- dia- and antiferro-magnetics and the theories that describe them. In addition, magnetic phenomena and magnetic materials in technological applications will be introduced.

### AMS432 Piezoelectric Materials [압전 재료]

Piezoelectricity that is one of the most interesting physical phenomena in solid-state physics will be introduced and discussed in this course. Given that the most widely used piezoelectric materials are ferroelectric materials, our discussion will cover a range of material classes, i.e., from dielectrics to ferroelectrics from fundamentals to applications. This lecture aims primarily at providing an extensive overview on the state-of-the-art in piezoelectrics and related materials from fundamentals to applications, followed by in-depth discussion on the remaining challenges and future directions for the researchers of next generation.

### AMS433 Introduction to Ceramics [세라믹 물성학]

This course is designed to provide students with the core understanding necessary to pursue the subject of ceramics as it now exists and to be prepared for any surprises likely to emerge. Key concepts will be developed in a sequence which builds on firm foundations, using the materials learned so that their significance is continuously reinforced. The nature of defects which intrudes upon the perfect geometry of ideal crystal structures, migration of matter and charge, chemical and phase equilibria are among the subjects discussed.

### AMS454 Nano-Materials Reliability [나노소재 신뢰성]

This course covers mechanical behavior of zero through three dimensional nanstrucutre materials. Since nano-materials generally has high surface-to-volume ratio and are generally attached to other materials such as substrates, it is important and interesting to understand their mechanical behavior. This course provides ideas to resolve reliability issues in nano devices such as delamination, crack propagation, and degradation failure during design and manufacturing.

### AMS471 Polymer Composites [고분자 복합재료]

The demand for composite materials is ever increasing with regard to both mechanical and multi-functional properties (such as electrical and thermal conductivity). The understanding of basic structure and properties of materials that are currently being used for composite materials is essential to develop novel materials. In addition, nano-composites are of great interest due to their promising potential replacing with conventional composite materials. The main background of this course is introducing the fundamentals of science and technologies associated with composites. The lecture is to help undergraduate student understand the requirement of materials for composites and relationship between reinforcing material and matrix.

### AMS491~4 Special Topics in Advanced Materials Science I~II [첨단소재과학 특론 I~II]

This course covers cutting-edge technologies with applications in advanced materials science and engineering, especially on advanced structural materials, characterization, multifunctional metallic composites, polymer materials, spintronic materials, bio-inspired materials, electronic materials, graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

## □ Semiconductor Materials Engineering (SE)

### SCM202 Introduction to Materials Science and Engineering [재료공학개론]

The need for new materials is now increasing as both the mechanical and (opto-)electronic devices become small, light, and integrated. The understanding of basic structures and properties of materials in the areas of metals, semiconductors, ceramics, and polymers is essential to develop new materials. The main background of this course is educating the fundamental sciences and techniques associated with various structures, properties, and engineering process. This lecture is to help students understand the relationship between microstructures of materials and physical (mechanical, electrical, magnetic, optical) and chemical properties.

### SCM203 Physical Chemistry I: Thermodynamics of Materials [재료물리화학 I: 열역학]

This course is one of the fundamental courses in Materials Science and Engineering as a topic in the field of Applied Physical Chemistry, and is focused on the understanding of material properties and fundamental phenomena related to material processes. Specific topics will include gas state properties and structures, thermodynamic laws, and equilibrium state.

### SCM204 Electromagnetics [전자기학]

This course aims to help the students understand the fundamentals of electromagnetics, involving the electric and magnetic properties of materials with an emphasis on solids. Specifically, this course examines electric and magnetic quasistatic forms of Maxwell's equations applied to diverse materials and situations. We want to tease out these laws of electromagnetism, especially about electromagnetic fields and forces from our everyday experiences by specific examples of how electromagnetic phenomena manifest themselves. Then, we can use the scientific method to come to understand the enormous variety of electromagnetic phenomena in terms of a few relatively simple laws.

### SCM250 Modern Physics of Materials [재료현대물리]

The course is directed at the development of a background in the basic physics required to understand the behavior of electrons in atoms, molecules and solids. Examples to illustrate the application of these techniques will be centered in the free and nearly free electron theory of solids. The application of modern physics to many state-of-the-art materials analysis techniques will be demonstrated throughout the course.



### SCM251 Introduction to Nanomaterials [나노재료개론]

Low-dimensional materials such as nanodot, nanotube, graphene, is considered as a promising future materials for nanotechnology, due to its unique size-dependent properties (mechanical, thermal, chemical, electronic, optical, and magnetic). This course will cover an interdisciplinary introduction to processing, structure, and properties of materials at the nanometer scale.

### SCM290 Introduction to Computational Materials Science [전산재료과학개론]

In this class, a couple of basic numerical analyses will be discussed and the hands- on experience of those concepts will be practiced using C program (or MATLAB, if needed). The first main topics include C basics, including basic expressions, variables, matrices, arrays, vectors, flow control, functions, string treatment, structure, i/o handling, and etc. After that, a few of the basic concepts on random numbers will be discussed because the second topic of the class, the mesoscopic computational materials science methods for microstructural evolution, such as the Monte Carlo simulations, and Cellular Automata, will utilize the random number generation modules.

### SCM313 Mechanical Behavior of Materials [재료의 기계적거동]

This course explores the phenomenology of mechanical behavior of materials at the macroscopic level and the relationship of mechanical behavior to material structure and mechanisms of deformation and failure. Topics covered include elasticity, viscoelasticity, plasticity, creep, fracture, and fatigue. Case studies and examples are drawn from structural and functional applications that include a variety of material classes: metals, ceramics, polymers, thin films, composites, and cellular materials.

### SCM321 Instrumental Analysis for Materials [재료분석기기]

Modern advances in materials science heavily rely on the development of various characterization techniques and related instruments, which have provided a deep and profound understanding of materials across a whole range of length scales: from bulk to nano- and atomic scale. This class is one- semester survey course on the basic principles of materials characterization techniques, aiming for upper-level undergraduate students in the school of materials science and engineering and other related fields. We will cover most widely used characterization tools in materials science (and indeed available at UNIST), focusing on their fundamental operational principles, various information they can provide, their practical instrumentation, and applications to recent practical materials research.

### SCM330 Nano–Electroceramics [나노 전자세라믹스]

A ceramic is an inorganic, non-metallic solid. Modern state-of-the-art electronics and displays are based on ceramic semiconducting materials such as silicon (Si) and gallium arsenide (GaAs). This course will present the principles and concepts of electronic device operation and fabrication (e.g. how transistors work and how they are made) using ceramic nanomaterials, mainly focusing on Si and GaAs. It begins with the electrical and structural properties of ceramic nanomaterials and the operation of the ceramic-based p-n junctions and transistors.

### SCM350 Solid State Physics of Materials [재료고체물리]

This course aims to provide fundamental understanding of the miscroscopic and mascroscopic physical peoperties of matter. A basic understanding of solid state physics is important for materials scientists and applied physicists in all areas of study, and for many other related disciplines as well. This course provides a basic understanding of what makes solids behave the way they do, how they are studied, and the basic interactions which are important.

### SCM351 Thin Film Technology [박막공학]

The need for thin films is now increasing as the electronic devices become small, light and integrated. In addition, fabrication of thin films from bulk materials is necessary to maximize their performance. Therefore, in this course we study the basic principles and techniques for the fabrication of thin films, the characterization methods and the applications of thin films.

### SCM354 Introduction to Semiconductor [반도체개론]

Concerning present and projected needs, this course provides a strong intuitive and analytical foundation for dealing with solid state devices. Emphasis is placed on developing a fundamental understanding of the internal working of the most basic solid state device structures, such as silicon based, metal-semiconductor contact, PN junction, MOS capacitor, bipolar transistor, and MOSFET.

### SCM355 Introduction to Nano-Energy Materials [나노에너지재료]

This course deals with basic nano-energy materials such as metal, semiconductor, oxide, and carbon based materials to realize electronic, photovoltaic, electrochemical, piezoeletric, and thermoelectric devices. In addition, students will learn fundamental principles of the charge carrier transport of nano-scale materials in devices and their characterization tools.

### SCM356 Nanophotonics [나노포토닉스]

Nanophotonics is the study of the behavior of light on the nanometer scale. In this course, the basic concept of nanophotonics and its applications will be covered. Students learn the novel properties of light at the nanometer scale as well as highly power efficient and new functional devices for engineering applications including optics, or the interaction of light with particles or substances, at deeply subwavelength length scales, and measurement technologies such as near-field scanning optical microscopy (NSOM), photoassisted scanning tunnelling microscopy, and surface plasmon optics.

### SCM452 Semiconducting Devices [반도체소자]

Concerning present and projected needs, this course provides a strong intuitive and analytical foundation for dealing with solid state devices. Emphasis is placed on developing a fundamental understanding of the basic process used in integrated- circuit (IC), such as vacuum, thin films, etching, lithography, diffusion, thermal process, ion implantation etc.



### SCM453 Semiconducting Processing [반도체공정]

This class is one-semester introductory course on semiconductor (more generally, electronic materials) processing and nanofabrication techniques, designed for upper-level undergraduate students in the school of materials science and engineering and other related fields. It will provide a complete overview of the different semiconductor processes involved in micro- and nanoscale fabrication, including crystal growth and doping, thermal oxidation, ion implantation, lithography and etching, followed by some back-end manufacturing processes. The past and current developments of vacuum science and plasma physics will be covered, too. Later part of lectures will discuss about the current status and challenges in silicon VLSI technologies and introduce a series of emerging nanofabrication techniques. Students will obtain basic understanding of the fundamental engineering and science of nanoelectronics fabrication.

### SCM455 Display Engineering [디스플레이공학]

This course will provide the basic concept of display devices such as organic light-emitting diodes (OLEDs), liquid crystal display (LCD), and so on. The basic principle of devices such as how to operate, how to calculate and increase the device efficiency and which kinds of materials used will be studied.

### SCM472 Introduction to Flexible Electronics [유연 전자소자 개론]

Flexible electronics is a technology for fabricating opto-electronic devices with mechanically flexible and stretchable forms using rigid and soft materials, including plastic substrates. This course provides an introduction to recent trends in flexible and wearable electronic devices, and the physics and chemistry of soft, elastic materials for the flexible electronics.

### SCM491~4 Special Topics in Semiconductor Materials Engineering I~II [반도체재료공학 특론 I~II]

This course covers cutting-edge technologies with applications in Semiconductor Engineering, especially on semiconductor processing and devices. It also includes semiconductor-related issues, such as polymers, spintronics materials, organic/inorganic optical materials, low-dimensional materials, optoelectronic materials. This content can be changed depending on instructor.

# School of Energy and Chemical Engineering

## 1. School Introduction

The School of Energy and Chemical Engineering was designed for an emerging field combining chemical engineering principles with research about energy conversion and storage. Students can learn fundamental science and engineering principles that can be used to improve the quality of life on earth and solve the most challenging issues of the 21st century. The field of Energy and Chemical Engineering encompasses a wide range of interests including green chemical processes, chemical engineering, advanced materials, and energy conversion and storage. Students can achieve in-depth knowledge and hands-on experience on catalysts, nanomaterials and devices, polymers, fine chemicals, applied molecular chemistry, and other chemical and energy engineering-related subjects.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Energy Engineering (ENE)

The Energy Engineering track will cover the principles and application of the energy conversion (fuel cells, solar cells) and energy storage devices (rechargeable batteries, hydrogen storage). It is interdisciplinary program in which students can learn about the broad applications of electrochemistry, design of new energy-related materials, and understanding of energy conversion and storage devices. This track aims to produce creative scientific minds that are familiar with the principles of materials chemistry, electrochemistry, material engineering, and energy conversion and storage system.

#### 2) Chemical Engineering (ACE)

The Chemical Engineering track is a discipline focusing on the application of chemical engineering to a variety of specific areas, including energy and the environment, catalysis, reaction engineering, systems and process design, nanotechnology, polymers and colloids and biotechnology. It is a multi-scale engineering program in which students can learn about the creative design of new chemicals, materials, processes and systems by translating molecular level information into novel engineering principles. This track aims to produce brilliant and creative scientific minds that are familiar with the principles of chemical engineering and the cutting-edge equipment available at the state-of-the-art facilities provided by UNIST.



### □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| ENE | Required | 31 | 12 | |
| | Elective | 23 | 6 | |
| ACE | Required | 28 | 15 | |
| | Elective | 26 | 3 | |

### □ Fundamental Course for each track

▶ Required Experimental Courses

| Track | Course No. | Required Experimental course | Semester |
|---|---|---|---|
| ENE | ENE223 | Lab for Energy Materials | Choose two |
| | ENE314 | Energy Conversion and Storage Lab | |
| | ENE323 | Solar Cells Lab | |

| Track | Course No. | Required Experimental course | Semester |
|---|---|---|---|
| ACE | ACE302 | Advanced Chemical Engineering Laboratory | Choose two |
| | ACE341 | Engineering Biology Laboratory | |
| | ACE361 | Organic/Physical Chemistry Laboratory | |

※ Complete based on 1TR

## 3. Curriculum ※ Opening courses are subject to change

### □ Energy Engineering (ENE)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ENE | ENE211 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | Identical: ACE201, CHM211 | 1 |
| | ENE212 | Physical Chemistry Ⅰ<br>물리화학 Ⅰ | 3-3-0 | Identical: ACE203, CHM231 | 1 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ENE | ENE213 | Analytical Chemistry<br>분석화학 | 3-3-0 | Identical: CHM291 | 1 |
| | ENE221 | Organic Chemistry Ⅱ<br>유기화학 Ⅱ | 3-3-0 | Identical: ACE202, CHM212 | 2 |
| | ENE222 | Physical Chemistry Ⅱ : Kinetics<br>물리화학 Ⅱ : 동역학 | 3-3-0 | | 2 |
| | ENE223 | Lab for Energy Materials<br>에너지 재료 실험 | 2-0-4 | | 2 |
| | ENE226 | Polymer Concepts<br>고분자과학개론 | 3-3-0 | Identical: ACE351, CHM372, AMS270 | 2 |
| | ENE311 | Inorganic Chemistry Ⅰ<br>무기화학 Ⅰ | 3-3-0 | Identical: ACE304, CHM351 | 1 |
| | ENE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ACE312 | 2 |
| | ENE313 | Solid State Chemistry Ⅰ<br>고체화학 Ⅰ | 3-3-0 | Identical: ACE321, CHM454 | 1 |
| | ENE314 | Energy Conversion and Storage Lab<br>에너지 변환 및 저장실험 | 2-0-4 | | 1 |
| | ENE322 | Instrumental Anaysis<br>기기분석 | 3-3-0 | Identical: ACE391, CHM391 | 1 |
| | ENE323 | Solar Cells Lab<br>태양전지실험 | 2-0-4 | | 1 |
| **Total Credit** | | | **36** | | |

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ENE | ENE216 | Fundamentals of Materials Science<br>재료과학개론 | 3-3-0 | Identical: AMS202 | 2 |
| | ENE218 | Fundamentals of<br>Energy Conversion Systems<br>에너지 변환 시스템 개론 | 3-3-0 | | - |
| | ENE316 | Electronic Devices<br>전자소자 | 3-3-0 | | 1 |
| | ENE317 | Fundamentals of Energy Materials<br>에너지재료개론 | 3-3-0 | Identical: CHM313 | 1 |
| | ENE319 | Physical Chemistry Ⅲ : Quantum Mechanics<br>물리화학 Ⅲ : 양자역학 | 3-3-0 | | 1 |
| | ENE321 | Polymer Material Science<br>고분자재료과학 | 3-3-0 | Prerequisite: ENE226<br>Identical: ACE352 | 2 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ENE | ENE326 | Inorganic Chemistry Ⅱ<br>무기화학 Ⅱ | 3-3-0 | Identical:<br>ACE326, CHM352 | 2 |
| | ENE327 | Solid State Chemistry Ⅱ<br>고체화학 Ⅱ | 3-3-0 | Prerequisite:<br>ENE311, ENE313 | - |
| | ENE400 | Special Topics in ECS Ⅰ<br>에너지공학특론 Ⅰ | 3-3-0 | | - |
| | ENE401 | Special Topics in ECS Ⅱ<br>에너지공학특론 Ⅱ | 3-3-0 | | - |
| | ENE402 | Special Topics in ECS Ⅲ<br>에너지공학특론 Ⅲ | 3-3-0 | | - |
| | ENE403 | Special Topics in ECS Ⅳ<br>에너지공학특론 Ⅳ | 3-3-0 | | - |
| | ENE404 | Special Topics in ECS Ⅴ<br>에너지공학특론 Ⅴ | 3-3-0 | | - |
| | ENE410 | Phase Transformation<br>재료상변태 | 3-3-0 | | 2 |
| | ENE412 | Principle of Solution Processing<br>용액공정개론 | 3-3-0 | | 2 |
| | ENE413 | Introduction to<br>New Energy Conversion and Storage<br>신에너지 변환 및 저장 개론 | 3-3-0 | | 2 |
| | ENE414 | Surface Analytical Chemistry<br>표면분석화학 | 3-3-0 | | 2 |
| | ENE415 | Solid State Physics<br>고체물리학 | 3-3-0 | | 1 |
| | ENE416 | Introduction to<br>Nanoscience and Nanotechnology<br>나노과학 및 기술 | 3-3-0 | Identical:<br>ACE416, CHM371 | 1 |
| | ENE420 | Fundamentals of Energy Organic Materials<br>에너지유기재료개론 | 3-3-0 | | 1 |
| | ENE421 | Fundamentals of<br>Semiconductor Fabrication<br>반도체공정개론 | 3-3-0 | | 2 |
| | ENE422 | Fundamentals of Electrochemical System<br>전기화학시스템개론 | 3-3-0 | Prerequisite: ENE212 | 1 |
| | ENE423 | Introduction to Application Technologies<br>of Energy Devices : ESS & EV<br>에너지기기 응용기술 개론 : ESS & EV | 3-3-0 | | 1 |
| ESE | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| **Total Credit** | | | **72** | | |

## □ Chemical Engineering (ACE)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ACE | ACE201 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | Identical:<br>ENE211, CHM211 | 1 |
| | ACE203 | Physical Chemistry Ⅰ<br>물리화학 Ⅰ | 3-3-0 | Identical:<br>ENE212, CHM231 | 1 |
| | ACE212 | Introduction to Chemical Process<br>화학공정개론 | 3-3-0 | | 1 |
| | ACE231 | Chemical Engineering Thermodynamics<br>화공열역학 | 3-3-0 | | 2 |
| | ACE302 | Advanced Chemical Engineering Laboratory<br>첨단화학공학실험 | 2-0-4 | | 1 |
| | ACE311 | Chemical Reaction Engineering<br>반응공학 | 3-3-0 | Prerequisite: MTH201,<br>ACE203 or ACE231 | 2 |
| | ACE331 | Transport Phenomena :<br>Momentum, Heat, and Mass Transfer<br>전달현상 : 운동량, 열, 물질전달 | 3-3-0 | Prerequisite: MTH201,<br>ACE203 or ACE231 | 1 |
| | ACE332 | Advanced Fluid Mechanics<br>고급유체역학 | 3-3-0 | | |
| | ACE341 | Engineering Biology Laboratory<br>생물화학공학실험 | 2-0-4 | | 2 |
| | ACE351 | Introduction to Polymer Science and Engineering<br>고분자과학개론 | 3-3-0 | Prerequisite: ACE201 | 1 |
| | ACE361 | Organic/Physical Chemistry Laboratory<br>유기물리화학실험 | 2-0-4 | Identical: ENE226,<br>CHM372, AMS270 | 2 |
| **Total Credit** | | | **30** | | |

1) Students who choose ACE as their 2nd Track required to take five courses from required courses group and this applies to those students who admitted in 2018 and onwards.



▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ACE | ACE202 | Organic Chemistry Ⅱ<br>유기화학 Ⅱ | 3-3-0 | Identical: ENE221, CHM212 | 2 |
| | ACE240 | Engineering Biochemistry<br>공학생화학 | 3-3-0 | | 2 |
| | ACE241 | Fundamentals in Engineering Biology<br>공학생물학 | 3-3-0 | | 1 |
| | ACE242 | Machine Learning<br>for Chemical Engineering<br>화학공학 머신러닝 | 3-3-0 | | 1 |
| | ACE301 | Computational Methods<br>for Chemical Engineering<br>화학공학전산 | 3-3-0 | | 2 |
| | ACE304 | Inorganic Chemistry Ⅰ<br>무기화학 Ⅰ | 3-3-0 | Identical: ENE311, CHM351 | 1 |
| | ACE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ENE312 | 1 |
| | ACE321 | Solid State Chemistry<br>고체화학 | 3-3-0 | Prerequisite: ACE203,<br>ACE311 or ENE222<br>Identical: ENE313, CHM454 | 1 |
| | ACE326 | Inorganic Chemistry Ⅱ<br>무기화학 Ⅱ | 3-3-0 | Identical: ENE326, CHM352 | 2 |
| | ACE340 | Biochemical Engineering<br>생물화학공학 | 3-3-0 | | 1 |
| | ACE352 | Polymer Materials<br>고분자재료 | 3-3-0 | Prerequisite: ACE351<br>Identical: ENE321 | 2 |
| | ACE391 | Instrumental Analysis<br>기기분석 | 3-3-0 | Identical: ENE322, CHM391 | 2 |
| | ACE401 | Special Topics in Chemical Engineering Ⅰ<br>화학공학특론 Ⅰ | 3-3-0 | | 1,2 |
| | ACE402 | Special Topics in Chemical Engineering Ⅱ<br>화학공학특론 Ⅱ | 3-3-0 | | |
| | ACE403 | Special Topics in Chemical Engineering Ⅲ<br>화학공학특론 Ⅲ | 3-3-0 | | |
| | ACE404 | Special Topics in Chemical Engineering Ⅳ<br>화학공학특론 Ⅳ | 3-3-0 | | |
| | ACE405 | Special Topics in Chemical Engineering Ⅴ<br>화학공학특론 Ⅴ | 3-3-0 | | |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ACE | ACE416 | Nanomaterials Chemistry<br>나노재료화학 | 3-3-0 | Prerequisite: ACE203, ACE311 or ENE222, ACE304<br>Identical: ENE416, CHM371 | 2 |
| | ACE431 | Introduction to Catalysis<br>촉매개론 | 3-3-0 | | 1 |
| | ACE432 | Chemical Engineering Mathematics<br>화공수학 | 3-3-0 | | |
| | ACE441 | Introducton to Molecular Biotechnology<br>분자생물공학 | 3-3-0 | | 2 |
| ENE | ENE216 | Fundamentals of Materials Science<br>재료과학개론 | 3-3-0 | Identical: AMS202 | 2 |
| | ENE222 | Physical Chemistry Ⅱ : Kinetics<br>물리화학 Ⅱ : 동역학 | 3-3-0 | | 2 |
| | ENE319 | Physical Chemistry Ⅲ : Quantum Mechanics<br>물리화학 Ⅲ : 양자역학 | 3-3-0 | | 1 |
| AMS | AMS351 | Thin Film Technology<br>박막공학 | 3-3-0 | | 1 |
| NME | NME452 | Nano-Semiconducting Devices<br>나노반도체소자 | 3-3-0 | | 1 |
| | NME454 | Nano-Materials Reliability<br>나노소재신뢰성 | 3-3-0 | | 1 |
| CHEM | CHM232 | Physical Chemistry Ⅱ<br>물리화학 Ⅱ | 3-3-0 | | 2 |
| | CHM291 | Analytical Chemistry Ⅰ<br>분석화학 Ⅰ | 3-3-0 | Identical: ENE213 | 1 |
| | CHM333 | Physical Chemistry Ⅲ<br>물리화학 Ⅲ | 3-3-0 | | 1 |
| **Total Credit** | | | **99** | | |





## 5. Course Descriptions

### □ Energy Engineering (ENE)

**ENE211 Organic Chemistry I [유기화학 I]**

Introduction to the classification, structure, reactions, and reaction mechanisms of carbon compounds. The objective of the course is that students will understand the classification, structure, nomenclature, reactions, reaction mechanisms, and synthesis of carbon compounds including halocarbons, alkenes, and alcohols. Thereby, this course can provide a solid foundation in the fundamentals of organic chemistry essential for the rational study of polymers, materials, biochemistry and molecular biology.

**ENE212 Physical Chemistry I [물리화학 I]**

The course is a general study of thermodynamics in the areas of physical chemistry covering the classical nature of energy conversion between heat, mechanical work, and the macroscopic variables such as temperature, volume and pressure in chemical systems. Thermodynamics provides the essential strategies for (1) calculating energy conversion, for example, in engines and (2) for determining the equilibrium composition of chemically reacting systems.

**ENE213 Analytical Chemistry [분석화학]**

The course handles general separation, spectroscopical identification, and quantification of the chemical components of interest. Qualitative analysis gives a rough identity of the chemical species in a sample and quantitative analysis gives more specific amount of one or more of these components. This course also treats the methods for qualitative and quantitative analyses including any instrumental approaches. This course helps you prepare analytical ability and design your experiments in chemistry.

**ENE216 Fundamentals of Materials Science [재료과학개론]**

This course will cover essential knowledge on a broad range of topics of materials science such as crystal structures and physical properties of materials. Through this course, students will take a chance to have an insight into various materials which are of critical importance for energy applications.

**ENE218 Fundamentals of Energy Conversion Systems [에너지 변환 시스템 개론]**

This course is designed to introduce the system and design of energy conversion and storage devices for renewable energy sources. Students will first learn about energy sources available on earth including kinetic, solar, and chemical. Next, the course will provide students with a review of the thermodynamic concepts behind energy constant and energy transfer via an energy conversion device. Finally, this course will tie together concepts of renewable energy sources and thermodynamics teaching students about design elements for energy conversion and storage devices, in which renewable energy sources are converted and stored.

### ENE221 Organic Chemistry II [유기화학 II]

This course deals with the structure, nomenclature, reactions, reaction mechanisms, and synthesis of carbon compounds that contain oxygen and nitrogen. This is the second part of a two-semester organic chemistry course offered to introduce students to the principles of organic chemistry and to communicate the excitement of scientific discovery. The basic objective of organic chemistry II is to continue to lay a solid foundation of organic chemistry for students of future advanced studies in chemistry and other important areas such as biochemistry, medical fields, applied life sciences that require thorough understanding of organic chemistry.

### ENE222 Physical Chemistry II : Kinetics [물리화학 II : 동역학]

This course is designed to provide an understanding of kinetics as it applies to chemical reactions from the microscopic viewpoint and the theoretical foundation required for designing chemical reactors for controlling chemical reactions. Chemical kinetics includes investigations of how different experimental conditions can influence the speed of a chemical reaction and yield information about the reaction's mechanism and transition states, as well as the construction of mathematical models that can describe the characteristics of a chemical reaction.

### ENE223 Lab for Energy Materials [에너지 재료 실험]

This course offers a hands-on opportunity of basic organic, inorganic, and physical chemistry experiments that are essential for students majoring in energy conversion and storage. We will particularly emphasize the basic lab skills related to the understanding and characterizations of energy materials.

### ENE226 Polymer Concepts [고분자과학개론]

This course offers general concepts of polymers. Understanding synthesis, characterization, and processing of polymers are important issues in contemporary materials science and engineering. Solid concepts on the structure-property relationship of synthetic polymers allow us to design new structures of polymers for application-specific purposes. Specifically, photo- and electro-active polymers will be discussed in details.

### ENE311 Inorganic Chemistry I [무기화학 I]

This course presents the concepts and models of chemistry. Topics include atomic and molecular structure, nomenclature, chemical reaction and stoichiometry, thermochemistry, periodicity, atomic structures and chemical bonding. This course is designed for students who plan to major in one of the engineering schools.

### ENE312 Electrochemistry [전기화학]

This course covers fundamentals related to electrochemical science and engineering as well as its applications. These include: redox reactions, electrochemical cells, thermodynamics related to electrochemistry, and electrode kinetics. In the second half of the course participants will explore how the aforementioned principles can be applied to electrochemical energy conversion, characterization of materials, and electrochemical sensors.



### ENE313 Solid State Chemistry I [고체화학 I]

This course focuses on the basic principles of solid state chemistry. Structural, chemical, and physical aspects of inorganic solids, such as ionic solids, metal, and molecular solids, will be discussed. The course explores the relationship between electronic structure, chemical bonding, and atomic order. It also investigates the characterization of atomic arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors, and polymers. Topics include: symmetry, basic crystallography, crystal structure, bonding in solids, characterization techniques (X-ray diffraction, microscopy, and spectroscopy) and crystal defects.

### ENE314 Energy Conversion and Storage Lab [에너지 변환 및 저장 실험]

This 2 credit lab course deals with experiments related to energy conversion and storage devices such as batteries and fuel cells. The synthesis and characterization of its devices will be performed. Finally, students will be assessed on the results of their electrochemical conversation and storage.

### ENE316 Electronic Devices [전자소자]

This course will cover the basic concepts, mechanisms, and applications of electronics devices. Topics will include band structure, electrical properties, optical properties of semiconductors, and its applications such as p-n junction diodes, field-effect transistors, light emitting diodes, and solar cells.

### ENE317 Fundamentals of Energy Materials [에너지재료개론]

This course offers basic understandings and applications of the energy materials related to energy conversion and storage using organic and inorganic materials. It covers the roles of bonding defining the fundamental types of energy materials and structural defects, kinetics, and expands to in-depth understanding of electronic, magnetic materials and metals and ceramics, glasses and polymers. Finally, this course focuses on the material selection and design for the solar cells, fuel cell, and batteries. It also investigates not only the basic concepts and materials for light harvesting system, light-emitting diodes, solar cells, and thermoelectrics. Through this course, students will have a chance to enhance their understanding to energy materials.

### ENE319 Physical Chemistry III : Quantum Mechanics [물리화학 III : 양자역학]

Topics in quantum mechanics, statistical mechanics, molecular dynamics, and molecular spectroscopy will be covered in this course. Through the study of quantum mechanics, students will further apply their knowledge of QM to understand how spectroscopy can be used to probe molecular systems. Through the study of molecular dynamics and molecular spectroscopy, students will discover how empirical reaction rates and molecular-based models can be used to gain insight into both simple and complex chemical systems.

### ENE321 Polymer Material Science [고분자재료과학]

This course covers fundamental concepts and physical properties of polymers to provide knowledge on the structure analysis of polymers and thus, one can understand structural characteristics of polymers depending upon chemical structures, molecular weights, molecular structures and morphologies. Specifically, the close relationship between chemical structures and physical properties will be discussed in details.

### ENE322 Instrumental Analysis [기기분석]

This course introduces the principles of analytical instruments which are needed in the characterization of various materials, and provides students with the opportunity to learn how to operate them in laboratories. This course deals with many integuments for spectroscopic analysis (NMR, FTIR, Raman, UV/VIS), x-ray analysis (XRD, XRF), surface analysis (AFM, XPS, SIMS), thermal analysis (DSC, TGA), Mass spectrometry, and electron microscopy (SEM, TEM).

### ENE323 Solar Cells Lab [태양전지실험]

This course builds upon the fundamental principles of solar cells, their composition and structures. The course will delve into the inner workings and composition of solar cell structures, photovoltaic applications and advanced theories and next generation applications of solar cell structures. Particular attention will be given to the use and assessment of laboratory instruments used in solar cell analysis.

### ENE326 Inorganic Chemistry II [무기화학 II]

Electronics structures, spectroscopic and magnetic properties of the coordination compounds will be discussed based on the crystal field theory and molecular orbital theory. In addition to the reactions and properties of the coordination compounds, and the catalytic properties of the organometallic compounds also will discussed.

### ENE327 Solid State Chemistry II [고체화학 II]

This course is the second part of a two-quarter solid state chemistry course offered to introduce students to the basic principles of solid state chemistry and its application to engineering systems. The techniques commonly used to synthesize and study solid materials are introduced in the second part. Topics cover phase diagrams, electrical, magnetic and optical properties of solids. Examples are drawn from energy generation and storage devices such as batteries, fuel cells, and superconductors.

### ENE400~404 Special Topics in ECS I~V [에너지공학특론 I~V]

This course is designed to introduce current topics in energy conversion and storage.

### ENE410 Phase Tranformation [재료상변태]

This course addresses a broad overview of the phase transformations that are important to understand the relationships between structure and property in materials.
The topics covered include classification of phase, transformations, nucleation, spinodal decomposition, growth, formal kinetics of transformations, diffusional phase transformations, diffusionless phase transformations, and non-equilibrium materials.

### ENE412 Principle of Solution Processing [용액공정개론]

This course provides an introduction to the principles and practice of the solution processing for energy devices. The discussion includes the solution chemistry, colloidal and interface, sol-gel process, inorganic-organic hybrid systems, and soft-materials chemistry, their theoretic parts, and analysis tools.



### ENE413 Introduction to New Energy Conversion and Storage [신에너지 변환 및 저장 개론]

Energy is inevitable for human life and a secure and accessible supply of energy is crucial for the sustainability of modern societies. However, continuation of the use of fossil fuels is set to face multiple challenges: depletion of fossil fuel reserves, global warming and other environmental concerns, geopolitical and military conflicts and of late. Therefore, the issue of new energy is becoming significant. This lecture aims to help you understand the basic concepts and reaction mechanisms of new energy conversion and storage device in terms of electochemistry. Also, this course will cover several experimental techniques of electrochemistry to measure the performance of new energy conversion and storage device.

### ENE414 Surface Analytical Chemistry [표면분석화학]

Surface analytical chemistry deals with the fundamental understanding of the surface chemistry and application of the surface analytical methods. Characterization of various phenomena such as corrosion and passivation at surfaces and interfaces, and will be covered.

### ENE415 Solid State Physics [고체물리학]

This course introduces various theoretical concepts and practical applications of solid-state physics at the beginning level. It focuses on a range of phenomena related with electron and phonon behaviors in periodic crystal structures. Topics include free electron models, crystal and magnetic structure, reciprocal space, ferroelectricity, energy band theory, and Berry phase. Understanding those fundamental properties will help design of various energy materials such as solar cell, Li-ion battery, fuel cell and various photocatalysts.

### ENE416 Introduction to Nanoscience and Nanotechnology [나노과학 및 기술]

This course deals with subjects in modern nanoscience and nanotechnology. As such, it will present the essential principles and application of the unique characteristics observed in materials of nanometer size.

### ENE420 Fundamentals of Energy Organic Materials [에너지유기재료개론]

The course is a general study of organic materials in the areas of energy storage devices storing readily convertible chemical energy to operate a variety of systems such as mobile electronic devices and electric vehicles. This course will cover investigations of how different organic materials can influence the kinetics of electrochemical reactions as well as the theoretical foundation required for designing organic materials controlling the performance of energy storage devices. Topics include microscopic structure of ionic compounds/ionic solutions and their properties.

### ENE421 Fundamentals of Semiconductor Fabrication [반도체공정개론]

The course is a general study of semiconductor fabrication processes in the areas of energy devices. This course will cover fundamentals of semiconductor fabrication from the crystal growth to various essential methods to fabricate practical energy devices. Topics on the fabrication processes include oxidation, lithography, etching, diffusion, ion implantation, deposition, etc. This course will give an opportunity to study fundamental knowledges on semiconductor fabrication processes for various energy devices.

### ENE422 Fundamentals of Electrochemical System [전기화학시스템개론]

This course is directed toward advanced undergraduate students in science and engineering and toward practitioners engaged in the development of electrochemical systems. In order to understand electrochemical systems; Thermodynamics, Electrode Kinetics, and Transport Phenomena are the three fundamental area which underlie the treatment in this course.

### ENE423 Introduction to Application Technologies of Energy Devices : ESS & EV [에너지기기 응용기술 개론: ESS & EV]

This course will deal with the application technology of the batteries in the area of ESS and EV. It will cover understanding of Power Industry and its modernization including new energy technologies such as renewables. It will, also, cover the details of use cases, the design logic of the system based on various battery technologies from the battery material to the system operation. During this course, the insight on the process of launching a basic idea into a commercial product will be acquired, too

## □ Chemical Engineering (ACE)

### ACE201 Organic Chemistry I [유기화학 I]

This class is an introduction to the classification, structure, reactions, and reaction mechanisms of carbon compounds. The class is set up so that, upon completion, students will understand the different characteristics of carbon compounds, including their classification, structure, nomenclature, reactions, reaction mechanisms, and synthesis. Some examples are halocarbons, alkenes, and alcohols. This course will provide a solid foundation in organic chemistry and the fundamentals essential for the subsequent study of biochemistry, molecular biology, and materials applications of polymers.

### ACE202 Organic Chemistry II [유기화학 II]

This course deals with the structure, nomenclature, reactions, reaction mechanisms, and synthesis of carbon compounds that contain oxygen and nitrogen. This is the second group of lectures in a two-semester organic chemistry course that is being offered to introduce students to the comprehensive, and somewhat rigorous, principles of organic chemistry and to communicate the excitement of scientific discovery. The basic objective of Organic Chemistry II is to continue to lay a solid organic chemistry foundation for further advanced studies in chemistry and other important fields, such as biochemistry, the medical field and applied life sciences, all of which require a thorough understanding of organic chemistry.

### ACE203 Physical Chemistry I [물리화학 I]

The course is a general study of thermodynamics in the areas of physical chemistry covering the classical nature of energy conversion between heat, mechanical work, and the macroscopic variables such as temperature, volume and pressure in chemical systems. Thermodynamics provides the essential strategies for (1) calculating energy conversion, for example, in engines and (2) for determining the equilibrium composition of chemically reacting systems.



### ACE212 Introduction to Chemical Process [화학공정개론]

This course enhances student understanding of the connection between the chemistry and the chemical process. Students will gain a solid understanding of what chemical processes do (convert raw materials into useful products using energy and other resources), and learn about the ways in which chemical engineers make decisions and balance constraints to come up with new processes and products. Students will learn material and energy balances as tools to achieve a real goal: workable, economical, and safe chemical processes and products.

### ACE231 Chemical Engineering Thermodyanamics [화공열역학]

This course offers students the basic understanding of thermodynamics and its practical applications relevant to various chemical processes. Through this course, students will learn the fundamental principles/ laws of thermodynamics and how they can be used to describe and analyze systematically a wide variety of thermodynamic properties and phenomena such as phase equilibria.
The 2nd track students are strongly recommended to take this course even if they have taken courses relevant to thermodynamics.

### ACE240 Engineering Biochemistry [공학생화학]

This course is designed to teach students the various biochemicals and their reactions occurring within living organisms. Students are expected to learn basic concepts and principles of biochemistry and to develop integrated knowledge base to be a successful (bio)chemical engineer who wants to find careers in the field of biotechnology. Topics discussed will include water, amino acids and proteins, enzymes, bioenergetics, glycolysis, the citric acid cycle, gluconeogenesis, electron transport chain, photosynthesis etc. Because this lecture discusses energetics and reaction mechanisms, it is highly desired that a student has completed both one-semester organic chemistry and one-semester physical chemistry before taking this course.

### ACE241 Fundamentals in Engineering Biology [공학생물학]

This course will emphasize the fundamental concepts of biology including an introduction to the disciplines of biochemistry, cell organization, metabolism, genetics, genomics, molecular biology, recombinant DNA technology and evolution that provide the foundation for modern biotechnology and bioengineering.

### ACE242 Machine Learning for Chemical Engineering [화학공학 머신러닝]

The subject is for undergraduate chemical engineers who wish to learn about computational methods for machine learning to apply these methods in solving problems and issues in chemical engineering. Students will learn basics of python programming language, and then use public libraries to practice regression, clustering, genetic algorithm, neural network (and deep leraning) and more. No prior knowledge on programming or python is required. The first half of the class will be on python basics, and the other half will be on machine learning methods.

### ACE301 Computational Methods for Chemical Engineering [화학공학전산]

A series of lectures provide basic principles of relevant numerical methods in the field of bio and chemical sciences. Lectures will be supplemented by hands-on demonstration and exercises with scientific computing tools, such as Matlab, Mathematica and Chemdraw. Introduction to scientific databases including NCBI and SciFinder will also be given.

### ACE302 Advanced Chemical Engineering Laboratory [첨단화학공학실험]

The basic unit processes are understood through these experiments. This course covers fixed and fluidized beds, batch and continuous stirred tank reactors, catalytic reactors, ion exchange unit, enzyme reactors and so on.

### ACE304 Inorganic Chemistry I [무기화학 I]

The course is designed for undergraduate students who plan to major in Energy and Chemical Engineering. The objective of this course is to understand basic principles of modern inorganic chemistry. Topics covered in this course include atomic and molecular structures, molecular shape and symmetry, group theory and molecular orbital theory, structure of solids, and acid-base and donor-acceptor chemistry.

### ACE311 Chemical Reaction Engineering [반응공학]

This course is designed to provide (1) an understanding of kinetics as it applies to chemical reactions from the microscopic viewpoint and (2) the basis required for designing chemical reactors for controlling chemical reactions.

### ACE312 Electrochemistry [전기화학]

This course covers fundamentals related to electrochemical science and engineering as well as its applications. These include: redox reactions, electrochemical cells, thermodynamics related to electrochemistry, and electrode kinetics. In the second half of the course participants will explore how the aforementioned principles can be applied to electrochemical energy conversion, characterization of materials, and electrochemical sensors.

### ACE321 Solid State Chemistry [고체화학]

This course focuses on the basic principles of solid state chemistry. Structural, chemical, and physical aspects of inorganic solids, such as ionic solids, metal, and molecular solids, will be discussed. The course explores the relationship between electronic structure, chemical bonding, and atomic order. It also investigates the characterization of atomic arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors, and polymers. Topics include: symmetry, basic crystallography, crystal structure, bonding in solids, characterization techniques (X-ray diffraction, microscopy, and spectroscopy) and crystal defects.



### ACE326 Inorganic Chemistry II [무기화학 II]

In this course, entire coordination chemistry will be handled. Especially, with the knowledge of molecular orbital theory, structures, bonding, and electronic spectra of molecules are discussed. In addition, reactions and mechanisms of coordination compounds and their practical applications for catalysis will be provided.

### ACE331 Transport Phenomena I [전달현상 I]

Most of the chemical operations are concerned with the behavior of fluids in process equipment. Underlying every step of the process are the principles of the transport phenomena, which include heat, mass and momentum transfer. The course covers balance equation, diffusion, steady-state, boundary conditions and flux laws. Differential Equations and Physical Chemistry I are pre-required courses, and further it is strongly recommended that students should take Chemical Engineering Thermodynamics or a corresponding course in advance.

### ACE332 Transport Phenomena II [전달현상 II]

This course offers an advanced level of understanding on the transport phenomena (momentum, heat, and mass transfer) from an unified viewpoint. We will learn how to derive rigorously the general balance equations from both microscopic and macroscopic approaches and how to apply such equations to solve a variety of real problems. We will also learn the microscopic interpretation of macroscopic transport properties such as viscosity, diffusion coefficient, heat conductivity, etc.

### ACE340 Biochemical Engineering [생물화학공학]

This course will suggest the role of biochemcialengineer and knowledge which is essentially required for successful biochemicalengineer to design bioreactor. Key core parts include the kinetics for enzymeand microbial growth. In addition, selection of bioreactor and operation will be discussed. Separation of bioproducts, especially therapeutic proteins will be included in this lecture course.

### ACE341 Engineering Biology Laboratory [생물화학공학실험]

This course introduces next-generation techniques in genetic, molecular, biochemical, and cellular engineering from a quantitative engineering perspective. Furthermore, the students will have the opportunity to have research-based experiences. The following areas are to be covered in the experimental portion of the course: 1) gene and genome engineering, 2) quantitative analysis of experiments, 3) cell cultivation, and 4) scientific communication based on useful applications of biological technologies.

### ACE351 Introduction to Polymer Science and Engineering [고분자과학개론]

This course introduces the students to natural and synthetic polymers and their physical and chemical properties. Students will learn the structure and property of polymers, starting from single chain conformations. One emphasis will be on the universal static and dynamic behavior of polymers in good solvents, semi-dilute solvents, theta solvents, and in melts. In addition, this course will cover the basic chemical synthesis and chemical properties of different polymers.

### ACE352 Polymer Materials [고분자재료]

This course is designed to provide an introduction to polymer materials science, including the synthesis, characterization, and applications of macromolecules. The emphasis will be on understanding the relationships between macromolecular architecture (and how it can be controlled and characterized), and the resulting chemical, physical and mechanical properties. Discussion of the recent literature will focus on how these structure-property relationships guide the design and synthesis of new materials and polymer-based reagents and devices. In addition, this course also intends to deal with the application of polymers towards various fields of science.

### ACE361 Organic/Physical Chemistry Laboratory [유기물리화학실험]

This course is a complementary laboratory course to the Organic Chemistry (II), Physical Chemistry (II), and Polymer Related lectures. It is designed to aid students in developing more advanced laboratory skills and techniques for the practical application of organic/physical chemistry principles. The students will also learn to report on and discuss their results using standard scientific methodologies. This course offers a variety of experiments designed to introduce the advanced experimental methods needed in organic, physical, and polymer chemistry.

### ACE391 Instrumental Analysis [기기분석]

This course introduces the principles of analytical instruments which are essential for the characterisation of various compounds and materials. The course provides students with the opportunity to learn how to operate them in laboratories. This course deals with many instruments for spectroscopic analysis (NMR, IR, UV/VIS, Raman), x-ray analysis (XRD, XRF), surface analysis (AFM, XPS, SIMS), thermal analysis (DSC, TGA), Mass spectrometry, and electron microscopy.

### ACE401~405 Special Topics in Chemical Engineering I~V [화학공학특론 I~V]

This course is designed to introduce current topics in advanced chemical engineering. Through this course, students will understand how basic knowledge in chemical engineering is used in the research and development of chemical products and processes and discuss the future trends in chemical engineering.

### ACE416 Nanomaterials Chemistry [나노재료화학]

This course is intended primarily as an introduction course to nanomaterials chemistry for undergraduate-level chemical engineers. The objective of this course is to understand basic concepts of nanoscience and nanotechnology and introduce general synthetic principles, characterization methods, and potential applications of nanostructured materials. These issues will be discussed with currently important nanomaterials, including silica, semiconducting, magnetic plasmonic, and carbon nanostructures.



### ACE431 Introduction to Catalysis [촉매개론]

Catalysts are materials that enhance the kinetics of chemical reactions. This course provides the basis to understanding the interaction between catalysts and molecules; and the effects of the catalyst's surface structure on chemical reactions.

### ACE432 Chemical Engineering Mathematics [화공수학]

This course is designed for advanced students in chemical engineering. The objective of this course is to apply the knowledge of reactor design and transport phenomena to mathematically formulating and describing physicochemical processes of chemical engineers' interest. Topics covered include the review of basic chemical engineering principles, ordinary differential equations, partial differential equations, and complex variables.

### ACE441 Introduction to Molecular Biotechnology [분자생물공학]

Molecular biotechnology results from the convergence of many areas of research, such as molecular biology, microbiology, biochemistry, immunology, genetics, and cell biology. This course introduces a basic introduction to several key techniques used in biological engineering and illustrative examples and laboratory investigations that explore modern approaches within the context of engineering and technology.

# School of Electrical and Computer Engineering

## ☐ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| EE | Required | 36 | 12 | |
| | Elective | 18 | 6 | |
| CSE | Required | 33 | 3 | |
| | Elective | 21 | 15 | |

## ☐ Fundamental Required Mathematics Course

| Track | Course No. | Required Experimental course |
|---|---|---|
| EE/CSE<br>※ Complete based on 1TR | MTH201 | Differential Equations |
| | MTH203 | Applied Linear Algebra |

## 3. Curriculum ※ Opening courses are subject to change

## ☐ Electrical Engineering (EE)

### ▶ Core Required: 1TR/2TR Common

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CSE | CSE201 | Digital Logic<br>디지털로직 | 3-3-0 | | 1 |
| EE | EE201 | Basic Circuit Theory<br>회로이론 | 3-3-0 | | 2 |
| | EE231 | Electromagnetics Ⅰ<br>전자기학 Ⅰ | 3-3-0 | | 1 |
| | EE311 | Signals and Systems<br>신호및시스템 | 3-3-0 | | 1 |
| Total Credit | | | 12 | | |





### ▶ Core Required: 1TR, Elective: 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| EE | EE301[1] | Microelectronics Ⅰ<br>전자회로 Ⅰ | 3-3-0 | Prerequisite: EE201 | 1 |
| | EE320[1] | Digital System Lab<br>디지털시스템실험 | 3-1-4 | Prerequisite: EE201, CSE201 | 1 |
| Total Credit | | | 6 | | |

1) Microelectronics Ⅰ (EE301) and Digital System Lab (EE320) become elective courses to EE 2nd track students who follow the 2019 curriculum and beyond.

### ▶ Required[1]: 1TR / Elective: 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| EE | EE211 | Probability and Introduction to Random Processes<br>확률과 랜덤프로세스개론 | 3-3-0 | | 2 |
| | EE302 | Microelectronics Ⅱ<br>전자회로 Ⅱ | 3-3-0 | Prerequisite: EE301 | 2 |
| | EE312 | Communications and Information Theory<br>통신 및 정보 이론 | 3-3-0 | Prerequisite: EE211 | 1 |
| | EE313 | Automatic Control<br>자동제어 | 3-3-0 | Prerequisite: EE311 | 2 |
| | EE321 | Electronics Experiment Laboratory<br>전자회로실험 | 3-1-4 | Prerequisite: CSE201, EE201, EE301 | 2 |
| | EE331 | Semiconductor Engineering Ⅰ<br>반도체공학 Ⅰ | 3-3-0 | | 1 |
| | EE411 | Digital Signal Processing<br>디지털신호처리 | 3-3-0 | Prerequisite: EE311 | 1 |
| Total Credit | | | 21 | | |

1) 'Required' means: 1st track students can choose 6 courses out of the 7 required courses above.

▶ Required[1]: 1TR / Elective: 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| | EE204 | Electromagnetism Ⅱ<br>전자기학 Ⅱ | 3-3-0 | | 2 |
| | EE233 | Physical Electronics<br>물리전자 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| | EE314 | Computer Networks<br>컴퓨터 네트워크 | 3-3-0 | Prerequisite: EE211<br>Identical: CSE351 | 2 |
| | EE332 | Semiconductor Engineering Ⅱ<br>반도체공학 Ⅱ | 3-3-0 | Prerequisite: EE331 | 2 |
| | EE341 | Electric Energy Systems<br>전기에너지공학 | 3-3-0 | | 2 |
| | EE342 | Microwave Engineering<br>마이크로파공학 | 3-3-0 | Prerequisite: EE201, EE231 | 2 |
| | EE344 | Antenna Engineering<br>안테나공학 | 3-3-0 | Prerequisite: EE204 | 2 |
| | EE401 | Analog Integrated Circuits<br>아날로그집적회로설계 | 3-3-0 | Prerequisite: EE301, EE302 | 1 |
| | EE402 | Introduction to VLSI Design<br>초고밀도 집적회로 설계 | 3-3-0 | Prerequisite: EE301 | 1 |
| **EE** | EE404 | Power Electronics<br>전력전자공학 | 3-3-0 | Prerequisite: EE301, EE313 | 1 |
| | EE412 | Advanced Information Systems<br>고급정보시스템 | 3-3-0 | Prerequisite: EE312 | 1 |
| | EE414 | Optimization Theory<br>최적화 이론 | 3-3-0 | | 2 |
| | EE431 | Semiconductor VLSI Devices Engineering<br>반도체집적소자공학 | 3-3-0 | | 2 |
| | EE432 | Optoelectronics<br>광전자공학 | 3-3-0 | | 1 |
| | EE480 | Special Topics in EE Ⅰ<br>전자및전기공학특론 Ⅰ | 3-3-0 | | - |
| | EE481 | Special Topics in EE Ⅱ<br>전자및전기공학특론 Ⅱ | 3-3-0 | | - |
| | EE482 | Special Topics in EE Ⅲ<br>전자및전기공학특론 Ⅲ | 3-3-0 | | - |
| | EE483 | Special Topics in EE Ⅳ<br>전자및전기공학특론 Ⅳ | 3-3-0 | | - |
| | EE484 | Special Topics in EE Ⅴ<br>전자및전기공학특론 Ⅴ | 3-3-0 | | - |
| **CSE** | CSE221 | Data Structures<br>데이터구조 | 3-3-0 | | 1,2 |
| **CSE** | CSE241 | Object Oriented Programming<br>객체 지향 프로그래밍 | 3-3-0 | | 1,2 |
| | CSE301[1] | Computer Architecture<br>컴퓨터구조 | 3-3-0 | Prerequisite: CSE201, CSE251[1] | 1 |
| | CSE311[2] | Operating Systems<br>운영체제 | 3-3-0 | Prerequisite: CSE251 | 2 |
| | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| **PHY** | PHY213 | Modern Physics<br>현대물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| | PHY301 | Quantum Physics Ⅰ<br>양자물리학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY315 | Solid State Physics Ⅰ<br>고체물리학 Ⅰ | 3-3-0 | Prerequisite: PHY301 | 2 |
| | PHY427 | Introduction to Plasma Physics<br>플라즈마 물리학 입문 | 3-3-0 | | - |
| | | **Total Credit** | **84** | | |

1) EE 1st track students can request prerequisite exemption of CSE251 for CSE301.

2) EE 1st track students can request prerequisite exemption for CSE311.

## □ Computer Science and Engineering (CSE)

▶ Core Required: 1TR/2TR Common

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| **CSE** | CSE241 | Object Oriented Programming<br>객체 지향 프로그래밍 | 3-3-0 | | 1,2 |
| | | **Total Credit** | **3** | | |

▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CSE | CSE201 | Digital Logic<br>디지털로직 | 3-3-0 | | 1 |
| | CSE221[1)] | Data Structures<br>데이터구조 | 3-3-0 | | 1,2 |
| | CSE232 | Discrete Mathematics<br>이산수학 | 3-3-0 | | 1,2 |
| | CSE251 | System Programming<br>시스템 프로그래밍 | 3-3-0 | | 1,2 |
| | CSE301 | Computer Architecture<br>컴퓨터구조 | 3-3-0 | Prerequisite: CSE201, CSE251 | 1 |
| | CSE311 | Operating Systems<br>운영체제 | 3-3-0 | Prerequisite: CSE251 | 2 |
| | CSE331[1)] | Introduction to Algorithms<br>알고리즘 | 3-3-0 | Prerequisite: CSE221 | 1,2 |
| | CSE341 | Principles of Programming Languages<br>프로그래밍언어 | 3-3-0 | Prerequisite: CSE241 | 1 |
| | CSE351 | Computer Networks<br>컴퓨터네트워크 | 3-3-0 | Prerequisite: EE211Identical: EE314 | 1 |
| EE | EE211 | Probability and Introduction to Random Processes<br>확률과 랜덤프로세스개론 | 3-3-0 | | 2 |
| **Total Credit** | | | **30** | | |

1) Data Structures (CSE221) and Introduction to Algorithms (CSE331) become elective courses to CSE 2nd track students who follow the 2019 curriculum and beyond.

▶ Elective

※ All EE, MTH courses in CSE curriculum are recognized as elective credits for CSE 1st track only, effective the academic year 2020.

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CSE | CSE332 | Theory of Computation<br>계산 이론 | 3-3-0 | Prerequisite: CSE232 | 2 |
| | CSE411 | Introduction to Compilers<br>컴파일러 개론 | 3-3-0 | Prerequisite: CSE341 | 2 |
| | CSE412 | Parallel Computing<br>병렬 컴퓨팅 | 3-3-0 | Prerequisite: CSE221, CSE311 | 1 |
| | CSE421 | Database Systems<br>데이터베이스 시스템 | 3-3-0 | Prerequisite: CSE221, CSE241 | - |
| | CSE462 | Artificial Intelligence<br>인공지능 | 3-3-0 | Prerequisite: CSE221 | 1 |



▶ Elective

※ All EE, MTH courses in CSE curriculum are recognized as elective credits for CSE 1st track only, effective the academic year 2020.

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CSE | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| | CSE464 | Software Engineering<br>소프트웨어공학 | 3-3-0 | Prerequisite: CSE241 | 2 |
| | CSE465 | Mobile Computing<br>모바일 컴퓨팅 | 3-3-0 | Prerequisite: CSE241, CSE351 | 2 |
| | CSE466 | Cloud Computing<br>클라우드 컴퓨팅 | 3-3-0 | Prerequisite: CSE311 | 1 |
| | CSE467 | Computer Security<br>컴퓨터보안 | 3-3-0 | Prerequisite: CSE251 | 1 |
| | CSE468 | Information Visualization<br>정보시각화기술 | 3-3-0 | Prerequisite: CSE221, CSE351 | 1 |
| | CSE471 | Computer Graphics<br>컴퓨터 그래픽스 | 3-3-0 | Prerequisite: CSE221, CSE241 | 2 |
| | CSE480 | Special Topic in CSE Ⅰ<br>컴퓨터 공학 특론 Ⅰ | 3-3-0 | | - |
| | CSE481 | Special Topic in CSE Ⅱ<br>컴퓨터 공학 특론 Ⅱ | 3-3-0 | | - |
| | CSE482 | Special Topic in CSE Ⅲ<br>컴퓨터 공학 특론 Ⅲ | 3-3-0 | | - |
| | CSE483 | Special Topic in CSE Ⅳ<br>컴퓨터 공학 특론 Ⅳ | 3-3-0 | | - |
| | CSE484 | Special Topic in CSE Ⅴ<br>컴퓨터 공학 특론 Ⅴ | 3-3-0 | | - |
| EE | EE201 | Basic Circuit Theory<br>회로이론 | 3-3-0 | | 2 |
| | EE313 | Automatic Control<br>자동제어 | 3-3-0 | Prerequisite: EE311 | 2 |
| | EE320 | Digital System Lab<br>디지털시스템실험 | 3-1-4 | Prerequisite: EE201, CSE201 | 1 |
| | EE402 | Introduction to VLSI Design<br>초고밀도 집적회로 설계 | 3-3-0 | Prerequisite: EE301 | 1 |
| | EE414 | Optimization Theory<br>최적화 이론 | 3-3-0 | | 2 |
| MTH | MTH204[1)] | Linear Algebra<br>선형대수학 | 3-3-0 | Prerequisite: MTH203 | 2 |
| | MTH260[1)] | Elementary Number Theory<br>정수론 | 3-3-0 | | 2 |
| **Total Credit** | | | **72** | | |

1) MTH204 and MTH260 are elective courses effective the academic year 2018 for CSE 1st track students.

2) CSE 2nd track students who follow the 2019 curriculum and beyond (including 2020) must complete at least 12 elective credits (out of the 15 elective credits) from CSE 300 or 400–level courses or CSE221.

3) There are no prerequisites listed above for 2nd track students except CSE241 effective the academic year 2020 and beyond.

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| EE | EE312<br>Introduction to Communications<br>통신개론 | ⇨ | EE312<br>Communications and Information Theory<br>통신 및 정보 이론 |
| | EE313<br>자동제어공학개론<br>Introduction to Control | ⇨ | EE313<br>자동제어<br>Automatic Control |
| | EE314<br>Introduction to Networks<br>네트워크개론 | ⇨ | EE314<br>Computer Networks<br>컴퓨터네트워크 |
| | EE331<br>IElectronic devices Ⅰ<br>전자소자 Ⅰ | ⇨ | EE331<br>Semiconductor Engineering Ⅰ<br>반도체공학 Ⅰ |
| | EE332<br>Electronic Devices Ⅱ<br>전자소자 Ⅱ | ⇨ | EE332<br>Semiconductor Engineering Ⅱ<br>반도체공학 Ⅱ |
| | EE341<br>전기에너지공학개론<br>Introduction to<br>Electrical Energy Systems | ⇨ | EE341<br>전기에너지공학<br>Electric Energy Systems |
| | EE412<br>통신시스템<br>Communication Systems | ⇨ | EE412<br>고급정보시스템<br>Advanced Information Systems |
| | EE404<br>전력전자공학개론<br>Fundamentals of Power<br>Electronics | ⇨ | EE404<br>전력전자공학<br>Power Electronics |
| | EE414<br>최적화이론개론<br>Introduction to Optimization | ⇨ | EE414<br>최적화이론<br>Optimization Theory |
| CSE | CSE351<br>Introduction to Networks<br>네트워크개론 | ⇨ | CSE351<br>Computer Networks<br>컴퓨터네트워크 |



## 5. Course Descriptions

### □ Electrical Engineering (EE)

**EE201 Basic Circuit Theory [회로이론]**

The aims of this course are to make the students understand the principles and the fundamental concepts of circuit analysis; to develop the student's familiarity and understanding in modeling and analyzing circuits through a variety of real-world examples; and to extend the student's ability to apply system analysis to other branches of engineering. Memory, circuits, communication and control system, design of VLSI, magnetically coupled networks, power analysis, laplace transform, capacitor, inductor, and polyphase circuits are main topics of the course. The PSpice tool will be introduced and used for basic experiments. This course is focused on both hands-on experience and design practice.

**EE211 Probability and Introduction to Random Processes [확률과 랜덤프로세스개론]**

This course introduces probability, random process, confidence interval, experimental design and hypothesis testing, statistical average, correlation, spectral analysis for wide sense stationary processes, random signals and noise in linear systems.

**EE231 Electromagnetics Ⅰ [전자기학 Ⅰ]**

This course is the first half of one-year electromagnetics course. It deals with basic electro- and magnetostatic phenomena and the related theories using vector calculus, such as coulomb and ampere law, electric and magnetic fields and their boundary conditions at the interface of different media. It also covers the fundamental aspects of dielectric and magnetic materials, and electromagnetic induction.

**EE233 Physical Electronics [물리전자]**

This course covers fundamentals of quantum mechanics and solid-state physics, which are essential for studying semiconductor devices such as photonic devices, electronic devices and integrate circuits. Various interesting device examples in real applications will be discussed together. This course will be a preparation for courses Electronic Devices I, Optoelectronics, and Nanophotoncis.

**EE301 Microelectronics Ⅰ [전자회로 Ⅰ]**

This course covers an introduction to electronic circuits and the analysis and design of transistor amplifiers. First, the course extensively explains the basic operation principles of diodes, BJTs, and MOSFETs derived from physical structures and gives a concept of equivalent device models. Then, we will study the design and analysis of basic BJT and FET amplifiers and differential and multi-stage amplifiers.

**EE302 Microelectronics Ⅱ [전자회로 Ⅱ]**

This course is the succession of the Microelectronics Ⅰ course where the material covered focused on single elements and their operational principles. In Microelectronics Ⅱ, amplifiers, current mirrors, frequency response, and stability will be covered to understand the implementation of microelectronics.

### EE311 Signals and Systems [신호및시스템]
This course introduces time-domain frequency domain response using Fourier series, Fourier transform, Laplace transform, discrete Fourier series and transform, sampling, z-transform, relationship between time and frequency descriptions of discrete and continuous signal and linear time invariant systems.

### EE312 Communications and Information Theory [통신 및 정보 이론]
This course introduces core concepts in analog and digital communication systems. The topics include Fourier transform, communication signals, amplitude modulation (AM), phase and frequency modulation (PM and FM), noise in communications, techniques in analog to digital transformation (sampling and quantization), and an introduction to source and channel coding.

### EE313 Automatic Control [자동제어]
This course introduces fundamentals of linear systems control: mathematical modeling, analysis, and design of systems, transfer function, root locus, bode diagram, nyquist method, and state space method.

### EE314 Computer Networks [컴퓨터 네트워크]
This course provides the fundamental concepts of computer networking and exercises for network programming. The topics covered in this course are data link, networking, transport, and application layers.

### EE320 Digital System Lab [디지털 시스템 실험]
This experiment course related to basic circuit theory and digital systems is focused on both hands-on experience and design practice with the following experiments: 1. Utilization of experimental equipments such as oscilloscope, power supply, and function generator, 2. Basic electric circuit theory with R, L, and C circuit networks, 3. Various digital circuit and systems, 4. Design specific digital system for given functionality as a term project.

### EE321 Electronics Experiment Laboratory [전자회로실험]
Experiments related to circuit theory and electronic circuits are performed. This course is focused on both hands-on experience and design practice with the following experiments: Circuit theory: 1. Measuring equipments and RC transient response, 2. Phasor and AC steady-state response, 3. 3-phase circuits. Electronic circuit: 4. Diode and BJT characteristics, 5. BJT and MOSFET amplifier, 6. Application of operational amplifiers. Design: 7. Sine/square wave function generator design, 8. Active filter design, 9. DC power supply design.

### EE331 Semiconductor Engineering I [반도체공학 I]
This course covers fundamental physical concepts related to electronic devices, i.e., crystal structure of semiconductor materials, electronic energy band, dopants, carrier transport. Then it introduces the basic working principles of PN junction and Metal-Oxide-Semiconductor (MOS).



### EE332 Semiconductor Engineering II [반도체공학 II]
This course covers operation principles of various electronic devices such as Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET), Bipolar Junction Transistor (BJT), Junction FET (JFET) and High Electron Mobility FET (HEMT). Microwave, photonic and power devices will be discussed as well.

### EE341 Electric Energy Systems [전기에너지공학]
This course introduces elements of modern electrical energy systems, including energy resources, energy conversion, power delivery and processing. The course also covers the basic principles on power converters and electromechanical energy conversion.

### EE342 Microwave Engineering [마이크로파공학]
This course is intended to introduce the general background that is required for RF, microwave, mm-wave, and THz designs. After a brief review of EM and transmission line theory, microwave network and impedance matching concepts are introduced. With the understanding of microwave network, the design of microwave components including power divider, couplers, resonators, active RF circuits, and RF systems will be covered.

### EE344 Antenna Engineering [안테나공학]
This course introduces the fundamental principles of antenna engineering in wireless communications. Various types of antennas and their applications will be covered with focus on linear wire antennas, loop antennas, aperture antennas, and microstrip antennas. Modern array antenna technologies such as smart antennas, Radar, direction finding, and interference mitigation will also be explored.

### EE401 Analog Integrated Circuits [아날로그집적회로설계]
This course covers basic concepts of fabrication, operation and design techniques related to CMOS integrated circuits. It also covers analysis and design of analog ICs using analytic techniques and CAD tools. Topics include amplifiers, current sources, output circuits, and other analog blocks.

### EE402 Introduction to VLSI Design [초고밀도 집적회로 설계]
This course studies analysis and design techniques for implementations of very large-scale integrated (VLSI) circuits, MOS technology, logic, interconnect, and memory by using electronic design aid (EDA) tools. Topics include full custom design methodology of logic gate generations, timing/power simulations, layout, DRC/LVS rule checking, and floor plan. Projects will be conducted to develop and lay out circuits.

### EE404 Power Electronics [전력전자공학]
The objective of this course is to introduce essential elements for controling and interfacing electric power. Main topics include power rectifiers for AC-DC conversion, PFC circuits, various DC-DC converters, resonant converters, bidirectional converters, and inverters for DC-AC conversion. This course is focusing on static power conversions; however, an introduction to electromechanical energy conversion and the control and drives of electric machines will be served.

### EE411 Digital Signal Processing [디지털신호처리]
This course introduces sampling of continuous-time signals and reconstruction of continuous signals from samples, spectral analysis of signals, fast Fourier transform, design of finite and infinite impulse response filters, signal flow graphs and filter implementation methods.

### EE412 Advanced Information Systems [고급정보시스템]
This course covers fundamental techniques for digital communication systems. The topics include analog to digital transformation using sampling and quantization, baseband and bandpass digital transmission, and an introduction to source and channel coding.

### EE414 Optimization Theory [최적화 이론]
This course introduces the fundamentals of theories and applications for optimization. This course covers optimization theory, optimization algorithms, and optimization applications such as control, machine learning, communication and image and signal processing.

### EE431 Semiconductor VLSI Devices Engineering [반도체집적소자공학]
In this course, we study in depth how the various semiconductor devices operate by using analytical approach and computer simulation. The fabrication processes and the operating principles of the manufacturing equipments are also covered. Finally, the application of semiconductor devices to actual integrated circuits and new types of devices will be discussed.

### EE432 Optoelectronics [광전자공학]
This introductory course is intended to familiarize students with underlying principles of optoelectronic and optical communication devices. Topics of this course include an overview of laser, fiber optic communication systems, optics review, light wave fundamentals, light detectors, noise analysis, and system design.

### EE480 Special Topics in EE Ⅰ [전자및전기공학특론 Ⅰ]
This course introduces new research topics in the field of Electrical Engineering Ⅰ.

### EE481 Special Topics in EE Ⅱ [전자및전기공학특론 Ⅱ]
This course introduces new research topics in the field of Electrical Engineering Ⅱ.

### EE482 Special Topics in EE Ⅲ [전자및전기공학특론 Ⅲ]
This course introduces new research topics in the field of Electrical Engineering Ⅲ.

### EE483 Special Topics in EE Ⅳ [전자및전기공학특론 Ⅳ]
This course introduces new research topics in the field of Electrical Engineering Ⅳ.



### EE484 Special Topics in EE Ⅴ [전자및전기공학특론 Ⅴ]
This course introduces new research topics in the field of Electrical Engineering Ⅴ.

## □ Computer Science & Engineering (CSE)

### CSE201 Digital Logic [디지털 로직]
To understand the basic principles of digital logic circuit, this course introduces the fundamental concepts, components and operations of digital systems. The topics to be covered include the theories of binary numbers, Boolean algebra, combination/sequential logics, registers, and counters and their implementation via hardware description languages.

### CSE221 Data Structures [데이터구조]
This course introduces abstract data type concept such as array, queue, stack, tree, and graph to obtain the ability to program these abstract data types in computer programming languages.

### CSE232 Discrete Mathematics [이산수학]
This course introduces discrete objects, such as permutations, combinations, networks, and graphs. Topics include enumeration, partially ordered sets, generating functions, graphs, trees, and algorithms.

### CSE241 Object Oriented Programming [객체 지향 프로그래밍]
This course is a second programming course for Computer Science Engineering track with a focus on object-oriented programming. The goal of the course is to develop skills such as algorithm design and testing as well as the implementation of programs. This course requires students to implement a large number of small to medium-sized applications, and to learn how to use relevant development tools.

### CSE251 System Programming [시스템 프로그래밍]
Through this course, students are provided a programmer's view on how computer systems execute programs, store information, and communicate. This will enable students to become more effective programmers allowing students to consider issues such as performance, portability and robustness when programming. This course will also serve as a foundation for upper level courses such as operating systems, computer networks, and computer organization. Various topics such as machine-level code and its generation by optimizing compilers, performance evaluation and optimization, and memory organization and management will be covered.

### CSE301 Computer Architecture [컴퓨터구조]
This course provides students with a basic understanding of computer organization and architecture. It is concerned mostly with the hardware aspects of computer systems: structural organization and hardware design of digital computer systems; underlying design principles and their impact on computer performance; and software impact on computer.

### CSE311 Operating Systems [운영체제]

This course introduces the objective and various forms of operating systems. Also resource management mechanisms such as process management, memory management, storage management and synchronization tools are covered in this course.

### CSE331 Introduction to Algorithms [알고리즘]

This course introduces the basic concepts of design and analysis of computer algorithms: the basic principles and techniques of computational complexity (worst-case and average behavior, space usage, and lower bounds on the complexity of a problem), and algorithms for fundamental problems. It also introduces the areas of NP-completeness and parallel algorithms.

### CSE332 Theory of Computation [계산이론]

This course is an introductory course on the theory of computation. The topics covered in this course includes: mathematical modelling of computing mechanisms (automatons), formal languages, computability, and basic complexity theory.

### CSE341 Principles of Programming Languages [프로그래밍언어]

By studying the design of programming languages and discussing their similarities and differences, this course provide introduces the concept of modern programming languages and improves the ability to learn diverse programming languages.

### CSE351 Computer Networks [컴퓨터 네트워크]

This course provides the fundamental concepts of computer networking and exercises for network programming. The topics covered in this course are data link, networking, transport, and application layers.

### CSE411 Introduction to Compilers [컴파일러 개론]

This course introduces the design and implementation of compiler and runtime systems for programming languages. The topics covered include parsing techniques, lexcial and syntactic analysis, context analysis, and runtime systems.

### CSE412 Parallel Computing [병렬 컴퓨팅]

As we enter the multicore era, parallel and distributed computing techniques now permeate most computing activities. This course is designed to let students follow rapid changes in computing hardware platforms and devices, and understand the concepts of parallel computing architecture, parallel programming models, parallel computing applications, and performance analysis.



### CSE421 Database Systems [데이터베이스 시스템]

This course introduces the concept of databases and provides basic experience in database programming. This includes the design of relational model, relational algebra, and SQL. The second half of the class will focus on the under-the-hood of DBMS systems and database design principles are also in the scope of this course.

### CSE462 Artificial Intelligence [인공지능]

Can machines think? Many pioneers in computer science have investigated this question. Artificial Intelligence (AI) is a branch of computer science dedicated to the creation of machines with intelligence. This course aims to introduce students to the field of AI and make them familiar with fundamental techniques for building intelligent systems.

### CSE463 Machine Learning [기계 학습]

Machine learning is the science and engineering of building system that can learn from data. In recent years, machine learning has given us self-driving cars, effective web search, and accurate recommendation systems. This course will provide the theoretical underpinnings of machine learning, but also best practices in the machine learning industries. The courses include a broad introduction to machine learning, learning theory, and data mining.

### CSE464 Software Engineering [소프트웨어 공학]

This course introduces various software development methods, the nature of software and development projects, software development models, project planning, and project management.

### CSE465 Mobile Computing [모바일 컴퓨팅]

This course studies how mobile computing is different from conventional computing in the aspect of its concept, architecture and applications. Major enabling techniques of mobile computing such as sensing, mobile communication, machine learning, and system optimization for energy efficiency are explained with opportunities of implementing such technologies in Android platforms.

### CSE466 Cloud Computing [클라우드 컴퓨팅]

This course is to understand basic concepts and techniques of virtualization, cloud computing systems, and cloud platforms including x86 virtualization and virtual machine, virtual machine management, cloud resource management, and big data analytics platforms (MapReduce).

### CSE467 Computer Security [컴퓨터 보안]

This course introduces the principle and practice of securing modern computer systems. From the seminal works and state-of-the-art security mechanisms, students will learn to formulate the security problems and to devise their solutions.

### CSE468 Information Visualization [정보시각화 기술]

In this course, we will focus on “designing user new interfaces” and “information visualization techniques” and systems. A fundamental skill in software engineering is to rapidly implement and evaluate efficient prototypes of an end-user application for deployment. This course will introduce foundational skills for high-fidelity graphical and visual user interface prototyping and development with state-of-the-art software interface design toolkits.

### CSE471 Computer Graphics [컴퓨터 그래픽스]

This course introduces the theory behind the computer graphics for displaying 3D objects and the algorithms to improve the reality of the 3D computer graphics and provides the experience of 3D computer graphics programming with OpenGL.

### CSE480 Special Topics in CSE Ⅰ [컴퓨터공학특론 Ⅰ]

This course introduces new research topics in the field of Computer Science & Engineering Ⅰ.

### CSE481 Special Topics in CSE Ⅱ [컴퓨터공학특론 Ⅱ]

This course introduces new research topics in the field of Computer Science & Engineering Ⅱ.

### CSE482 Special Topics in CSE Ⅲ [컴퓨터공학특론 Ⅲ]

This course introduces new research topics in the field of Computer Science & Engineering Ⅲ.

### CSE483 Special Topics in CSE Ⅳ [컴퓨터공학특론 Ⅳ]

This course introduces new research topics in the field of Computer Science & Engineering Ⅳ.

### CSE484 Special Topics in CSE Ⅴ [컴퓨터공학특론 Ⅴ]

This course introduces new research topics in the field of Computer Science & Engineering Ⅴ.





# School of Life Sciences

## 1. School Introduction

School of Life Sciences aims to improve human health by interdisciplinary research and education in biomedical sciences and engineering through the convergence of fundamental biology, nanotechnology and various engineering principles. In order to meet the increased needs in healthcare and advanced medical theragnostics, school of life sciences pursues to train creative global leaders through interdisciplinary research and education programs.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Biological Sciences (BIO)

Ground-breaking research achievements in biological sciences such as the human genome project, stem cell research, innovative therapies in cancers, and age-related diseases highlight the potential of biological sciences to be one of the most promising areas in science. The Biological Sciences track aims to produce brilliant and creative scientific minds that are familiar with the principles of biology and the cutting-edge equipment available at the state-of-the-art facilities provided by UNIST. Researches in the Biological Sciences track at UNIST are focused on age-related diseases, neuroscience, stem cells and regenerative medicine.

#### 2) Biomedical Engineering (BME)

Biomedical engineering (BME) aims to improve human health by applying advanced engineering principles and methods to medical and biological problems, such as disease diagnostics, health monitoring, treatment, and therapy. In order to meet the increased needs in healthcare, BME track at UNIST pursues to train creative global leaders through top-class interdisciplinary research and education programs. Our competitive research programs include biochips, biomedical devices, biomimetics, biomaterials, molecular imaging, tissue engineering, drug delivery, bio-robots, genomics and genome engineering.

## ☐ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| BIO | Required | 23 | 15 | |
| | Elective | 31 | 3 | |
| BME | Required | 30 | 12 | |
| | Elective | 24 | 6 | |

## 3. Curriculum ※ Opening courses are subject to change

## ☐ Biological Sciences (BIO)

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BIO | BIO211 | Biochemistry I<br>생화학 I | 3-3-0 | Identical: CHM321 | 1 |
| | BIO305 | Principles of Neuroscience I<br>신경과학의 원리 I | 3-3-0 | | 1 |
| | BIO332 | Anatomy and Physiology<br>해부 및 생리학 | 3-3-0 | | 2 |
| | BIO431 | Bioinformatics<br>생정보학 | 3-3-0 | | 1 |
| | BIO432 | Immunology<br>면역학 | 3-3-0 | | 1 |
| Total Credit | | | 15 | | |

### ▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BIO | BIO201 | Molecular Biology<br>분자생물학 | 3-3-0 | | 2 |
| | BIO261 | Biochemistry Laboratory<br>생화학실험 | 2-0-4 | | 1,2 |
| | BIO301 | Cell Biology<br>세포생물학 | 3-3-0 | | 1 |
| Total Credit | | | 8 | | |



### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BIO | BIO202 | Molecular Biology Laboratory<br>분자생물학실험 | 2-0-4 | | 2 |
| | BIO221 | Biochemistry II<br>생화학 II | 3-3-0 | Identical: CHM322 | 2 |
| | BIO231 | The Chemical Basis of Life<br>생명현상의 화학적 이해 | 3-3-0 | | 2 |
| | BIO302 | Developmental Biology<br>발생학 | 3-3-0 | Prerequisite: BIO201 | 1 |
| | BIO303 | Neurobiology<br>신경생물학 | 3-3-0 | | 2 |
| | BIO304 | Current Topics in Biological Sciences<br>현대생명과학동향 | 2-2-0 | | 1 |
| | BIO306 | Principles of Neuroscience II<br>신경과학의 원리 II | 3-3-0 | | 2 |
| | BIO314 | Instrumental Bioanalysis<br>생물기기분석 | 3-3-0 | | 1 |
| | BIO316 | Protein Science<br>단백질학 | 3-3-0 | | 2 |
| | BIO320 | Genome Integrity and Cancer<br>유전체 총체성과 암 발생의 이해 | 3-3-0 | Prerequisite: BIO201 | 1 |
| | BIO331 | Microbiology<br>미생물학 | 3-3-0 | | 1 |
| | BIO333 | Genetics<br>유전학 | 3-3-0 | Prerequisite: BIO201 or BIO211 | 2 |
| | BIO361 | Cell Biology & Genetics Laboratory<br>세포생물학 및 유전학실험 | 2-0-4 | | 1 |
| | BIO401 | Special Topics in Biological Sciences I<br>생명과학특론 I | 3-3-0 | | 1 |
| | BIO402 | Special Topics in Biological Sciences II<br>생명과학특론 II | 3-3-0 | | 1 |
| | BIO403 | Special Topics in Biological Sciences III<br>생명과학특론 III | 3-3-0 | | - |
| | BIO412 | Microbial Physiology<br>미생물생리학 | 3-3-0 | Prerequisite: BIO331 | 1 |
| | BIO433 | Biochemistry of<br>Signal Transduction and Regulation<br>세포신호전달 | 3-3-0 | | 1 |
| | BIO435 | Cancer Biology<br>암생물학 | 3-3-0 | Prerequisite: BIO201, BIO301 | 1 |
| | BIO436 | Gene Expression<br>유전자발현 | 3-3-0 | | 1 |
| | BIO438 | Endocrinology and Metabolism<br>내분비 및 대사학 | 3-3-0 | | 2 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BME | BME202 | Genomics<br>게놈학 | 3-3-0 | | 2 |
| | BME203 | Introduction to Bioinformatics<br>생물정보학 개론 | 3-3-0 | | 1 |
| | BME313 | Biomedical Instrumentation Laboratory<br>의료기기실험 | 3-1-4 | | 2 |
| | BME321 | Introduction to Biomedical Optics<br>의광학 개론 | 3-3-0 | | 2 |
| | BME324 | Cancer Genomics<br>암게놈학 | 3-3-0 | | 1 |
| | BME326 | enome Technology<br>게놈응용기술학 | 3-3-0 | | 1 |
| | BME330 | Introduction to Phenomics<br>피노믹스: 표현형의 분석과 이해 | 3-3-0 | | 2 |
| | BME331 | Biomedical Imaging<br>의생명이미징 | 3-3-0 | | 2 |
| | BME411 | Biological Physics<br>생물물리학 | 3-3-0 | | 1 |
| CHEM | CHM211 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | Identical: ACE201, ENE211 | 1 |
| | CHM212 | Organic Chemistry Ⅱ<br>유기화학 Ⅱ | 3-3-0 | Identical: ACE202, ENE221 | 2 |
| | CHM231 | Physical Chemistry Ⅰ<br>물리화학 Ⅰ | 3-3-0 | Identical: ACE203, ENE212 | 1 |
| Total Credit | | | 96 | | |

## □ Biomedical Engineering (BME)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BME | BME201 | Introduction to Network Biology<br>네트워크생물학개론 | 3-3-0 | | 2 |
| | BME211 | Introduction to Biomedical Engineering<br>생명공학개론 | 3-3-0 | | 1 |
| | BME311 | Transport Phenomena in Biological Systems<br>생체유체역학 | 3-3-0 | Prerequisite: MTH201 | 1 |
| | BME435 | Tissue Engineering<br>조직공학 | 3-3-0 | Identical: AMS360 | 1 |
| Total Credit | | | 12 | | |





▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BME | BME301 | Computational Methods for Biomedical Engineering<br>생명공학전산 | 3-3-0 | | 2 |
| | BME313 | Biomedical Instrumentation Laboratory<br>의료기기실험 | 3-1-4 | | 2 |
| | BME411 | Biological Physics<br>생물물리학 | 3-3-0 | | 1 |
| | BME470 | BME Senior Design Ⅰ<br>BME 시니어 디자인 Ⅰ | 3-1-4 | | 1 |
| | BME480 | BME Senior Design Ⅱ<br>BME 시니어 디자인 Ⅱ | 3-1-4 | | 2 |
| BIO | BIO301 | Cell Biology<br>세포생물학 | 3-3-0 | | 1 |
| Total Credit | | | 18 | | |

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BME | BME202 | Genomics<br>게놈학 | 3-3-0 | | 2 |
| | BME203 | Introduction to Bioinformatics<br>생물정보학 개론 | 3-3-0 | | 1 |
| | BME212 | Bio-instrumental Analysis<br>바이오기기분석 | 3-3-0 | | 2 |
| | BME319 | Optical Imaging<br>광학이미징 | 3-3-0 | | 1 |
| | BME320 | Advanced Biomedical Instruments<br>최신의료기기 | 3-3-0 | | 2 |
| | BME321 | Introduction to Biomedical Optics<br>의광학 개론 | 3-3-0 | | 2 |
| | BME322 | Physiology for Engineers<br>공학도를 위한 인체생리학 | 3-3-0 | | 2 |
| | BME324 | Cancer Genomics<br>암게놈학 | 3-3-0 | | 1 |
| | BME326 | Genome Technology<br>게놈응용기술학 | 3-3-0 | | 1 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| BME | BME330 | Introduction to Phenomics<br>피노믹스: 표현형의 분석과 이해 | 3-3-0 | | 2 |
| | BME331 | Biomedical Imaging<br>의생명이미징 | 3-3-0 | | 2 |
| | BME401 | Special Topics in Biomedical Engineering Ⅰ<br>생명공학특론 Ⅰ | 3-3-0 | | - |
| | BME402 | Special Topics in Biomedical Engineering Ⅱ<br>생명공학특론 Ⅱ | 3-3-0 | | - |
| | BME403 | Special Topics in Biomedical Engineering Ⅲ<br>생명공학특론 Ⅲ | 3-3-0 | | - |
| | BME404 | Advanced Topics in Genomics<br>고급 게놈학 | 3-3-0 | | 2 |
| | BME406 | Drug Delivery Systems<br>약물전달시스템 | 3-3-0 | | 2 |
| | BME407 | Bio-image Processing<br>바이오 영상 처리 | 3-3-0 | | 2 |
| | BME408 | Biomedical Chemistry<br>의생명화학 | 3-3-0 | | 1 |
| | BME421 | Nano-Bioengineering<br>나노바이오공학 | 3-3-0 | | 1 |
| | BME433 | Lasers and Biomedical Applications<br>레이저와 바이오 응용 | 3-3-0 | | 1 |
| BIO | BIO201 | Molecular Biology<br>분자생물학 | 3-3-0 | | 2 |
| | BIO202 | Molecular Biology Laboratory<br>분자생물학실험 | 2-0-4 | | 2 |
| | BIO211 | Biochemistry Ⅰ<br>생화학 Ⅰ | 3-3-0 | Identical: CHM321 | 1 |
| | BIO221 | Biochemistry Ⅱ<br>생화학 Ⅱ | 3-3-0 | Identical: CHM322 | 2 |
| | BIO261 | Biochemistry Laboratory<br>생화학실험 | 2-0-4 | | 1,2 |
| | BIO332 | Anatomy and Physiology<br>해부 및 생리학 | 3-3-0 | | 2 |
| | BIO333 | Genetics<br>유전학 | 3-3-0 | Prerequisite: BIO201 or BIO211 | 2 |
| | BIO304 | Current Topics in Biological Sciences<br>현대생명과학동향 | 2-2-0 | | 1 |
| | BIO431 | Bioinformatics<br>생정보학 | 3-3-0 | | 1 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MEN | MEN230 | Solid Mechanics Ⅰ<br>고체역학 Ⅰ | 3-3-0 | | 1 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 1 |
| | MEN413 | Computational Fluid Dynamics<br>전산유체역학 | 3-3-0 | Prerequisite: MEN301, MEN320 | 2 |
| | MEN451 | Introduction to MEMS<br>MEMS개론 | 3-3-0 | | 2 |
| SDC | SDC302 | Circuit Theory & Lab<br>회로이론 및 실습 | 3-2-2 | | 1 |
| | SDC405 | 3D Printing<br>3D 프린팅 | 3-3-0 | | 1 |
| AMS | AMS360 | Bio-inspired Materials Science<br>바이오소재과학 | 3-3-0 | Identical: BME435 | 2 |
| ENE | ENE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ACE312 | 2 |
| | ENE322 | Instrumental Anaysis<br>기기분석 | 3-3-0 | Identical: ACE391, CHM391 | 1 |
| ACE | ACE441 | Introducton to Molecular Biotechnology<br>분자생물공학 | 3-3-0 | | 2 |
| EE | EE432 | Optoelectronics<br>광전자공학 | 3-3-0 | | 1 |
| CSE | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| PHY | PHY213 | Modern Physics<br>현대물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| | PHY303 | Thermal and Statistical Physics<br>열 및 통계물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| CHM | CHM371 | Introduction to Nanochemistry<br>나노화학개론 | 3-3-0 | Identical: ACE416, ENE416 | 2 |
| | CHM421 | Introduction to Chemical Biology<br>화학생물학개론 | 3-3-0 | | 1 |
| | MGT473 | Entrepreneurship and Venture Management<br>창업과 벤처 | 3-3-0 | | 1 |
| **Total Credit** | | | **139** | | |

▶ Suggested Path of the 1st track elective courses

If students whose 1st track is Biomedical Engineering are interested in one of focused areas such as Biomedical Devices and Regenerative Medicine, Imaging, Physical Biology, and Genomics, Biomedical Engineering (BME) highly recommends the following elective courses according to your academic interests. The classes listed in the table are strongly recommended, but are not required for graduation.

| Year | Biomedical Devices and Regenerative Medicine | Physical Biology | Imaging | Genomics |
|---|---|---|---|---|
| 2 | BME212<br>BIO261 | BME203<br>BME202<br>BIO211 | | BME202 BME203<br>BIO201 BIO211 |
| 3 | BME311<br>BIO301<br>BIO332 | BME324 | BME319<br>BME321 | BME324<br>BIO333<br>BME323 |
| 4 | BME406 BME435 | BME404 | BME407<br>BME433 | BME404<br>BIO431 |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| BIO | <New> | ⇨ | BIO435 (Elective)<br>Cancer Biology<br>암생물학 |
| | <New> | ⇨ | BIO320 (Elective)<br>Genome Integrity and Cancer<br>유전체 총체성과 암 발생의 이해 |
| | BIO201 (Required)<br>Molecular Biology<br>분자생물학 | | BIO201 (1TR Required/ 2TR Elective)<br>Molecular Biology<br>분자생물학 |
| | BIO221 (1TR Required/ 2TR Elective)<br>Biochemistry Ⅱ<br>생화학 Ⅱ | ⇨ | BIO221 (Elective)<br>Biochemistry Ⅱ<br>생화학 Ⅱ |
| | BIO301 (Required)<br>Cell Biology<br>세포생물학 | | BIO301 (1TR Required/ 2TR Elective)<br>Cell Biology<br>세포생물학<br>선이수 삭제 |
| | BIO201. BIO211<br>BIO302 (Required)<br>Developmental Biology<br>발생학 | ⇨ | BIO302 (Elective)<br>Developmental Biology<br>발생학 |



## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| BIO | BIO305 (Elective)<br>Principles of Neuroscience Ⅰ<br>신경과학의 원리Ⅰ | | BIO305 (Required)<br>Principles of Neuroscience Ⅰ<br>신경과학의 원리Ⅰ |
| | BIO333<br>(1TR Required/ 2TR Elective)<br>Genetics<br>유전학 | ⇨ | BIO333 (Elective)<br>Genetics<br>유전학 |
| | BIO431 (Elective)<br>Bioinformatics<br>생정보학 | | BIO431 (Required)<br>Bioinformatics<br>생정보학 |
| | BIO432 (Elective)<br>Immunology<br>면역학 | ⇨ | BIO432 (Required)<br>Immunology<br>면역학 |
| | BIO433 (Elective)<br>Biochemistry of Signal Transduction and Regulation<br>세포신호전달 | ⇨ | 선이수 삭제 |
| | BIO438 (Elective)<br>Endocrinology and Metabolism<br>내분비 및 대사학 | ⇨ | 선이수 삭제 |
| BME | BME201 (Required)<br>Probability, Statistics and Biological Network<br>확률통계와 생물학적네트워크 | ⇨ | BME201 (Required)<br>Introduction to Network Biology<br>네트워크생물학개론 |
| | <New> | ⇨ | BME326 (Elective)<br>Genome Technology<br>게놈응용기술학 |
| | BME325 (Elective)<br>Introduction to Quantitative Biology<br>정량적생물학개론 | | <Closed> |
| | <New> | ⇨ | BME330 (Elective)<br>Introduction to Phenomics<br>피노믹스: 표현형의 분석과 이해 |
| | BME405 (Elective)<br>Design Principles of Life<br>생명의 설계원리 | | <Closed> |
| | BME408 (Elective)<br>Biomedical Chemistry<br>의생명화학<br>개설학기: 2학기 | ⇨ | BME408 (Elective)<br>Biomedical Chemistry<br>의생명화학<br>개설학기: 1학기 |

## 5. Course Descriptions

### □ Biological Sciences (BIO)

**BIO201 Molecular Biology [분자생물학]**
This course is designed to teach students about DNA with regard to its structure, replication, and roles in transcription and translation, as well as various related control mechanisms. It will also introduce the students to recent recombinant DNA technologies and the principles behind these methodologies.

**BIO202 Molecular Biology Laboratory [분자생물학실험]**
In this laboratory course, each student will be actively involved and conduct a series of experiments related to molecular biology subjects. The principles of each technique will also be discussed for future applications.

**BIO211 Biochemistry I [생화학I]**
This course is designed to teach students the various chemical processes occurring within every living organism. Topics discussed will include amino acids and proteins, molecules of heredity, enzymes, bioenergetics, glycolysis, the citric acid cycle, oxidative phosphorylation and gluconeogenesis, as well as others. This course will also cover macromolecules, their precursors and biosynthesis, and the chemical, physiological, and genetic regulation of biosynthesis.

**BIO221 Biochemistry II [생화학 II]**
This course is designed to teach students the various metabolic processes occurring within every living organism. Topics discussed will include bioenergetics, the citric acid cycle, oxidative phosphorylation, carbohydrate, lipid, and amino acid metabolisms, and their hormonal regulation.

**BIO231 The Chemical Basis of Life [생명현상의 화학적 이해]**
All processes that control the fate of cells and organisms are controlled by interaction of biomolecules – DNA, RNA, Proteins, Sugars, Lipids, Metabolites. We will explore the molecular, structural and chemical nature of these interactions. In each lecture, a biological topic will be paired with one or several chemical principles. After covering the fundamental principles, we will learn about how the knowledge and application of chemical reactivity and structure has enabled the biotechnology revolution and how it is applied in drug discovery. This course will teach students a basic understanding of chemical reactivity and structure needed that underlies all areas of modern biology and will help them in classes such as biochemistry and molecular biology.

**BIO261 Biochemistry Laboratory [생화학실험]**
Students will be trained with the latest biological sciences techniques through a series of laboratory courses. Each student will actively conduct, perform, record and report on various experiments during the semester. The principles behind each lab technique will be introduced and students will learn how to collect and interpret experimental results by preparing a laboratory report after each class.



**BIO301 Cell Biology [세포생물학]**
This course is designed to teach students about the cell at both a microscopic and molecular level. The lectures will focus on numerous related subjects, such as cell composition, cell structure, the cell cycle and its regulation, and cellular interactions with the environments.

**BIO302 Developmental Biology [발생학]**
Students will learn about the processes by which living organisms develop and grow. The control mechanisms involved in cell differentiation, embryonal development, growth, metamorphosis, and regeneration at both a molecular and genetic level will be taught and discussed.

**BIO303 Neurobiology [신경생물학]**
Neurobiology is a central component of modern biomedical sciences. The objective of this class is to help you gain a solid understanding of this discipline. You will be expect to understand the structures and functions of the key players, to understand the interaction between the components, to understand central principles that govern the network of nervous system, and to be able to apply this knowledge to solve noble problems.

**BIO304 Current Topics in Biological Sciences [현대생명과학동향]**
Biological science is one of the most exciting and rapidly developing areas of science. This course aims to inform students of recent topics in various fields of biological sciences such as molecular biology, cell biology, immunology, neuroscience, structural biology and developmental biology. The instructor will introduce current research topics and students are encouraged to share their opinions on the topics, discuss about challenging ideas and seek for possible answers to unanswered questions.

**BIO305~306 Principles of Neurosciences I ~ II [신경과학의 원리 I ~ II]**
The whole course of this class (Principles of Neuroscience 1 & 2) is intended for motivated students from all backgrounds. The major goal of this course is to introduce Neuroscience to students, focusing on the structure and function of the mammalian nervous system. Students will learn fundamental knowledge about the cellular and physiological properties of neurons, neuroanatomy, psychopharmacology, and how the activity of neurons can process sensory perception, motor control, and complex cognitive functions including emotion, motivation, learning, and memory. After completing the whole course, students will build a solid understanding of current scientific knowledge of the mammalian nervous system and brain.

**BIO314 Instrumental Bioanalysis [생물기기분석]**
This course is designed to give biological science and engineering students a fundamental understanding of bioanalytical tools and instruments. This course will cover the basic principles of qualitative and quantitative analyses of biomolecules, such as nucleic acids, carbohydrates, and proteins, and the fundamentals of instrumental bioanalysis, including electrochemical, chromatographic, spectroscopic, and spectrometric methods.

**BIO316 Protein Science [단백질학]**
This course will provide a general understanding of modern protein folding, structures, and protein

engineering strategies. Topics include the fundamentals of proteins and protein complexes, analytical methods for protein structures and characterization, and biological and biochemical methods in protein design and manipulation, including biomedical and industrial application of engineered proteins.

### BIO320 Genome Integrity and Cancer

This class focusses on the role of DNA repair in the genesis and therapy of cancer. DNA, the carrier of the genetic information is an inherently unstable molecule that is damaged by various chemicals and sources of radiation. DNA damage is induced in many ways: environmentally, by therapeutic agents or as integral part of cellular function. We will discuss the various pathways that cells have evolved to counteract DNA damage, on diseases caused by genome instability that are associated with cancer, aging, infertility, immunodeficiency and neurological abnormalities, and the role of DNA repair pathways in cancer therapy and genome engineering.

### BIO331 Microbiology [미생물학]

This course provides the basic concepts and fundamental aspects of microbiology, including genetics, physiology and classification. Topics covered will include the importance of microorganisms to ecosystems, their application to environmental issues, such as in bioremediation, and their various applications within diverse fields/industries.

### BIO332 Anatomy and Physiology [해부및생리학]

This course introduces the structure and function of tissues and organs. Their systemic regulation will be discussed.

### BIO333 Genetics [유전학]

This course is designed to teach students about all aspects of heredity and genes. The lecture series will include gene expression, variation, and regulatory mechanisms. In addition, recent research and technologies related with genetics will be presented.

### BIO361 Cell Biology & Genetics Laboratory [세포생물학 및 유전학실험]

In this laboratory course, each student will be actively involved and conduct a series of experiments related to cell biology and genetics topics. The principles of each technique will also be discussed for future applications.

### BIO412 Microbial Physiology [미생물생리학]

The purpose of this course is to provide an understanding of the structure and function of microorganisms, the relationship between structure and function in its environment. It will also provide the mechanisms of cell division, composition of microbial cell walls and membranes, aerobic and fermentative metabolism, and regulation of genes and metabolism.

### BIO431 Bioinformatics [생정보학]

This course provides basic knowledge and skills for genome data analysis. Microarray and sequence data analysis as well as exercises with software tools are included. Elementary Statistics is the prerequisite.



### BIO432 Immunology [면역학]

This course is designed to teach students about all aspects of the immune system in both health and disease. A series of lectures on immune cell components, development, and functions, the innate and acquired immune system, pathogenesis, malfunctions of the immune system, such as immunodeficiency and autoimmunity, inflammation and various immunological techniques and their applications will be given.

### BIO433 Biochemistry of Signal Transduction and Regulation [세포신호전달]

Cellular signaling in higher organism is a major topic in modern medical and pharmacological research. Also, signal transduction is a subject that ranks among the most rapidly developing fields in biomedical sciences. Diseases such as cancer, diabetes and cardiovascular disorders are caused in part by disturbances in cellular signaling processing, and the majority of therapeutic drugs target corresponding cellular pathways. Accordingly, this lecture will concentrate on signaling and regulation in animal systems and in man. It is the aim of this lecture to understand the biochemical and physiological properties of signaling molecules and their regulation. Furthermore, the tools used for signal transduction and the organizational principle of signaling pathways will be discussed in this lecture.

### BIO435 Cancer Biology [암생물학]

Cancer is defined as uncontrollable cell growth. The complexities of the causes and the different types of cells that give rise to this disease have underscored the need for a better understanding of the basic biology of cancer. Advancements in basic and biomedical research have led to more effective treatments, enhanced detection methods, and better prevention strategies. This course aims to provide a comprehensive overview of the biology and pathology of cancer. The first half of the course will focus on the genetic and molecular basis of cancer. We will explore the role of mutations in cancer cells, and how they lead to the dysregulation of essential biological properties like programmed cell death, cell proliferation and differentiation. The second half of the course will focus on the interface of cancer and medicine. Classical treatment methods will be compared with newer treatment strategies like targeted therapies. We will also explore the challenges associated with diagnosing cancers, as well as ways in which to prevent cancer.

### BIO436 Gene Expression [유전자발현]

Gene expression is a fundamental cellular process decoding genetic/epigenetic information in response to physiological needs such as growth, development, and homeostasis. This course is specially designed to understand how multiple regulatory mechanisms can give rise to spatial/temporal and quality/quantity controls in gene expression at both mRNA and protein levels, thus fine-tuning gene function.

### BIO438 Endocrinology and Metabolism [내분비 및 대사학]

This course will mainly focus on the metabolic syndrome and related signal transduction that are offered to students of Biochemistry, Cell Biology, and Molecular Biology. Students have to prepare the presentation of reviews and recent research articles.

### BIO401~3 Special Topics in Biological Sciences I~III [생명과학특론 I~III]
This course will provide in-depth coverage of current hot topics in biological sciences.

## □ Biomedical Engineering (BME)

### BME201 Introduction to Network Biology [네트워크생물학개론]
This course provides fundamental concepts and essential methods of the emerging “network science” required for understanding, but not limited to, biological networks. The course is organized in two parts. The first half will review the basics of probability, statistics and graph theory in concrete examples. The latter half covers the methods relevant for modern high-throughput biology and will include basic tools for the collection, analysis, and presentation of biological (big) data. A special emphasis is on the networks and systems approach to biological systems ranging from the networks of intracellular chemical reactions to protein-protein interactions to social and ecological systems under active research. Throughout the course lectures are combined with hands-on sessions that will improve the numeracy in life science research. Knowledge of programming language may be beneficial but not required. No prerequisites.

### BME202 Genomics Ⅰ [게놈학 Ⅰ]
Genomics is the new name for genetics. It is a core of modern biology. Any students who are interested in biology and biotechnology are strongly recommended to learn genomics. Genomics 1 is an introduction. It covers areas such as sequencing, alignment, DNA synthesis, and genome writing and editing. Students who took this subject will be able to understand life in terms of information processing with much knowledge on how to use technologies to solve problems such as curing cancer and aging.

### BME203 Introduction to Bioinformatics [생물정보학 개론]
This introductory course will cover the basic programming skills and algorithms used in bioinformatics research. Bioinformatics is a relatively new discipline in biomedical research, studying the information of biological system. Various knowledges, such as biological knowledge to ask the right question, logical insights to design the algorithm, computational skill to implement the program, and statistical knowledge to interpret large-scale data, are required to study bioinformatics. Among them, this class will mostly focus on the analysis of biological sequences, which is the fundamental format of biological information in nature.

### BME211 Introduction to Biomedical Engineering [생명공학개론]
This course is an introduction to Biomedical Engineering (BME) and will demonstrate to students how to apply engineering knowledge and skills to real-word problems in medicine and biology. Course will covers the basis of biology and physiology, medical instruments, biomaterials, medical imaging, and computational biology. It is intended to facilitate the student’s understanding in areas of BME and gain the core concept of BME, interdisciplinary research. Course is designed by composed lectures which provide the opportunity to learn various BME activities in academia as well as industry.



### BME212 BIO-instrumental Analysis [바이오기기분석]
Instrumental analysis is crucial to research in molecular biology, biomedical engineering, chemical engineering, and many other field. The aim of this course is to provide undergraduate students with an understanding analytical instruments, not to instrument be considered “black boxes”. In this course, we will cover the various types of microscopes, centrifugation techniques for separation, chromatographic technique (HPLC and GC), PCR, various spectrophotometric techniques (NMR, NIR, UV) in biomedical analysis.

### BME301 Computational Methods for Biomedical Engineering [생명공학전산]
This course provides key concepts and principles of numerical methods for biosciences and bioengineering. Lectures will be supplemented by hands-on demonstration and exercises by using scientific computing software tools, such as Matlab, Mathematica and/or their open source alternatives. Candidate topics to be covered include partial differential equations, time series analysis, stochastic modelling of biological processes, and graph-theoretic analysis of large-scale networks.

### BME311 Transport Phenomena in Biological Systems [생체유체역학]
This course introduces the fundamental principles of transport phenomena with the specific examples in medical, biological, and bioengineering applications. This course uniquely integrates biological and engineering concepts to help engineers to establish and critically analyze models of biological transport and reaction processes. It covers topics in fluid mechanics, mass transport and biochemical interactions.

### BME319 Optical Imaging [광학이미징]
The objective of this course is to understand the physical properties of light and its consequences on imaging. The course will cover the fundamentals of optics and various characteristics such as coherence, aberrations, polarization, electro-optics, acousto-optics and consider how they enable unique capabilities for light microscopy.

### BME320 Advanced Biomedical Instruments [최신의료기기]
The main goals of BME 320 are to introduce you to the basic system architecture, signal processing, working principle of biomedical engineering instruments, and the application of engineering technologies to biomedical problems and research activities of BME at UNIST. Course material will also cover highlighted medical instruments using recent journal articles.

### BME321 Introduction to Biomedical Optics [의광학 개론]
The objective of this course is to understand the working principle of various different areas of modern biomedical optics. Through this course, you will be able to understand the working principles of state-of-the-art microscope systems such as multiphoton, super-resolution, phase engineering, and tomography as well as light-tissue interaction for therapeutic applications.

### BME322 Physiology for Engineers [공학도를 위한 인체생리학]
This course teaches students qualitative and quantitative aspects of human physiology. It looks at biological

and physiological processes and phenomena, including a selection of mathematical models, showing how physiological problems can be mathematically formulated and studied. Also, this course covers the application of knowledge of engineering to cellular systems physiology including function, dysfunction, and the mechanisms that underlie treatment.

### BME324 Cancer Genomics [암게놈학]

This course will explore the role of genomics in disease (e.g. cancer) study, diagnosis, prognosis, and treatment. Each student will have an opportunity to explore publicly available genome samples to understand what can be learned from examining genetic alterations that can correlate with disease initiation and development. We will discuss how an individual's risk of developing a disease can be assessed based on small genetic changes in nucleotide sequence as well as on larger structural variations that affect entire regions of a chromosome.

### BME326 Genome Technology [게놈응용기술학]

This course provides the fundamental principles of next generation sequencing (NGS) and genome editing. The lecture series introduce underlying molecular mechanisms of massive parallel sequencing platforms and sequencing technologies to obtain specific information of the genomic and epigenomic environments. This course also discussed about technologies to edit genome information in living cells or organisms. This lecture series also provides the biological findings and insights from DNA technology.

### BME330 Introduction to Phenomics [피노믹스: 표현형의 분석과 이해]

The main goals of the lecture are to introduce phenomics via demonstrating various model organisms and experimental approaches to systemically acquire and analyze phenotypic data. The first half of the class will provide introduction of genetic model systems for the study of phenomics. The other half will mainly focus on introduction of advanced visualizing technologies for system-wide phenotyping.

### BME404 Advanced Topics in Genomics [고급 게놈학]

This course will review primary scientific research papers in the field of genomics. Each class, we will review one or two such papers in detail with some background and coverage of related research when appropriate. The paper to be discussed in detail will be assigned for reading.

### BME406 Drug Delivery Systems [약물전달시스템]

The way in which chemicals or drugs are administered have gained increasing attention to achieve prolong therapeutic effects and minimize the side effects. This course will provide undergraduate students with a basic understanding of the rationale behind the engineering of controlled drug delivery system, and design, development and optimization of drug delivery system. It covers physiological barriers in the human body including skin, gastrointestinal tract, nose, eyes, and brain, biopharmaceutical properties of drugs in drug transport, physiochemical principles in drug delivery, and engineering polymer systems for drug delivery.



### BME407 Bio-image Processing [바이오 영상 처리]

This course aims to provide a fundamental, brand-new techniques of image processing and computer vision topics for biomedical engineer. Our course will be on learning fundamental concepts and principles underlying biomedical image processing which are based on computer science and mathematics. Also, We treat vision as a process of inference from noisy and uncertain data and emphasizes probabilistic, statistical, data-driven approaches. Topics include image formation, transformation, filtering, segmentation, optimization, detection and motion recognition. Finally, this course will consist of several programming homeworks and projects by MATLAB. I believe that this course will be useful for your research of biomedical application.

### BME408 Biomedical Chemistry [의생명화학]

The course provides students with a general overview of the fundamental tasks performed by chemical elements in living organisms as well as the related methods and theories. This goes along with the elucidation of model systems and technical applications of both, concepts learned from nature as well as biological systems. The course will be given to study the interdisciplinary relationship of chemistry with biology, physics, pharmacy and medicine. The results of chemical research can be applied to understand chemical processes in cells and in the body, and new methods for drug transportation. Also, basic chemical ideas and determination of disease etiology are approached by developing techniques to ensure optimum interaction between biomedical platforms and human cells. The course is designed for senior level students in biomedical engineering, biological science, and related major, yet interested students on the junior level are welcome.

### BME411 Biological Physics [생물물리학]

This course will introduce students to skills of quantitative and semi-quantitative analysis applicable to broad number of topics even beyond biomedical topics but for purposes of class using the cell as a major focus. Topics include understanding basic structures and components of cells, designing, evaluating, and analyzing cellular experiments, and applying cell biology to biomedical research and engineering. Prerequisites are Biochemistry and Physical Chemistry or Thermodynamics.

### BME413 Biomedical Instrumentation Laboratory [의료기기실험]

This course will provide the basic concept and hands-on experience of biomedical device. The course will be balanced with lecture and experiment covering the topics such as biological signal measurement, signal processing, and data analysis using LabVIEW programming. Through this course, students will gain the skill how to design, build, and control biomedical device for laboratory research.

### BME421 Nano-Bioengineering [나노바이오공학]

This course discusses basic knowledge for interdisciplinary research in nanoscience, biology, electronic and mechanical engineering. This course, also, provides hand-on experiences on the modeling, microfabrication and characterization of bio-inspired microelectromechanical systems.

### BME431 Biomedical Imaging [의생명이미징]

An introduction to the principles of biomedical imaging and its applications. A series of lectures provide demonstrations of basic principles of noninvasive imaging methods in biology and medicine, including x-ray, PET, MRI, ultrasound and optical imaging. Lectures by the professor will be supplemented by in-class discussions of problems in research, and hands-on demonstrations of imaging systems.

### BME433 Lasers and Biomedical Applications [레이저와 바이오 응용]

The use of lasers in biomedical field has been tremendously increased for last two decades, ranging from optical diagnostics to laser therapy. This course will provide the fundamental understandings of lasers and laser-matter interactions, as well as various applications including optical imaging, diagnostics, and laser surgery. The course also covers the most recent advancements in laser technology for examples, fiber lasers and microlasers and their applications in biomedical field. This course is designed for senior undergraduate students, but not limited.

### BME435 Tissue Engineering [조직공학]

This course is designed for both undergraduate and graduate-level students who have the desire for an introductory understanding of tissue engineering (TE) elements involved in Regenerative Medicine (RM). The course aims to attain the following two major objectives: (1) Primary objective: understand and explore the basic engineering and medical principles behind the TE, (2) Secondary objective: Understand the basic non-engineering/ analytic skills necessary for real-world development of the ‘commercializable’ biomedical products. Ethics involved in the RM will be briefly reviewed. Students will gain experiences in real-life research topics and engaged to ‘mock-up’ research activities as well as business (commercialization) development.

### BME401∼3 Special Topics in Biomedical Engineeirng I∼III [생명공학특론 I∼III]

This course discusses recent research trends on Biomedical Engineering. Especially, the interdisciplinary research examples such as biochips or lab-on-a-chips for analysis of nucleic acids, proteins, and cells in molecular or cell level. Proposal writing and oral presentation are also required.

### BME470 BME Senior Design I & BME480 BME Senior Design II

All BME students are required to take a two-semester capstone course in the senior year: "Biomedical Engineering Senior Design I and II". This course was designed in order to BME seniors make the transition into industry through self-chosen team projects. Thus, course material emphasizes practical training such as entrepreneurship, market research, regulatory considerations, and client-based engineering project. Entire projects through two semesters are mentored by BME research faculty member. Students end their final semester with a demonstration of their prototype device and are judged by a panel of faculty and invited guests from industry. Through this course, BME senior students will learn how to identify product needs and assess potential obstacles, then use tools of project management and creativity development to solve real-world problems.





# School of Natural Science

## 1. School Introduction

The school of natural science was founded in 2010 to promote the basic science education and to facilitate the creative interdisciplinary research between science and engineering. Since then, it has been offering MS and Ph.D degrees. Natural Science strives to improve the quality of human life through finding and understanding basic rules in nature. Historically, the convergence of basic science and engineering has been a key process for the advance of human civilization. We believe that the systematic interdisciplinary research between natural science and engineering will be able to speed up the convergence of these two disciplines and UNIST proudly provides an unprecedented and unique education system in Korea for this purpose.
From 2014, the school of natural science provides three majors, mathematical sciences, physics, and chemistry for undergraduate and graduate students. For the purpose of performing world top class research, UNIST has been recruiting several top researchers. As a result, the School of Natural Science will host at least two International Business Belt Campus Research Centers. This school is ready to soar to the apex of science and technology.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Physics (PHY)

Physics forms a fundamental knowledge system and a framework of 'thinking' for almost every other contemporary science and technology. We incubate the next generation human resources to inherit and lead the diverse researches in modern physics by providing a set of related curriculums. In the physics track of UNIST, we offer not only basic physics courses such as classical mechanics, electromagnetism, quantum physics, statistical physics, mathematical physics and basic laboratory experiments, but also advanced courses for the future research such as solid state physics, optics, computational physics, plasma and beam physics, biological physics, particle physics, cosmology, advanced experiments, etc.

#### 2) Chemistry (CHEM)

Chemistry is a central science that seeks the understanding of nature and interactions between atoms and molecules. In addition to this essential scientific question, modern development such as nanoscience offers new chances to explore the world of 'beyondatoms and molecules. The department offers lectures and

experimental courses in all fields of chemistry: physical, organic, analytical, biological, and materials/polymers chemistry. The department stresses a research experience as an essential educational tool. Research opportunities with our world-class researchers are provided to all undergraduate students in the state-of-the art facilities and environment.

### 3) Mathematical Sciences (MTH)

Department of Mathematical Science explores the connections between mathematics and its applications at both the research and educational levels. In addition to focusing on traditional study in pure mathematics, our research at UNIST is devoted to encompass some of the most diverse and interdisciplinary research in the physical, business, economics, engineering, and biological sciences. The department provides a dynamic and engaging research environment in scientific computing, mathematical biology, finance, dynamical systems, image processing, number theory and analysis in PDEs. The undergraduate and graduate curriculum is planned with the following varied objectives: (1) to offer students an introduction to the fundamental study of quantity, structure, space, and change; (2) to prepare students for graduate study in pure or applied mathematics; (3) to serve the needs of students in fields that rely substantially on mathematics, such as the physics, biology, engineering, business and economics.

## □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| PHY | Required | 36 | 12 | |
| | Elective | 18 | 6 | |
| CHEM | Required | 33 | 12 | |
| | Elective | 21 | 6 | |
| MTH | Required | 33 | 12 | |
| | Elective | 21 | 6 | |



## 3. Curriculum ※ Opening courses are subject to change

## □ Physics (PHY)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| PHY | PHY201 | Classical Mechanics Ⅰ<br>고전역학 Ⅰ | 3-3-0 | Prerequisite:<br>PHY101, PHY103 | 1 |
| | PHY203 | Electromagnetism Ⅰ<br>전자기학 Ⅰ | 3-3-0 | Prerequisite:<br>PHY101, PHY103 | 1 |
| | PHY301 | Quantum Physics Ⅰ<br>양자물리학 Ⅰ | 3-3-0 | Prerequisite:<br>PHY101, PHY103 | 1 |
| | PHY303 | Thermal and Statistical Physics<br>열 및 통계물리학 | 3-3-0 | Prerequisite:<br>PHY101, PHY103 | 2 |
| **Total Credit** | | | **12** | | |

▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| PHY | PHY202 | Classical Mechanics Ⅱ [1]<br>고전역학 Ⅱ | 3-3-0 | Prerequisite: PHY201 | 2 |
| | PHY204 | Electromagnetism Ⅱ<br>전자기학 Ⅱ | 3-3-0 | Prerequisite: PHY203 | 2 |
| | PHY207 | Physics Lab Ⅰ<br>물리학실험 Ⅰ | 3-1-4 | Prerequisite:<br>PHY101, PHY103 | 2 |
| | PHY213 | Modern Physics<br>현대물리학 | 3-3-0 | Prerequisite:<br>PHY101, PHY103 | 2 |
| | PHY302 | Quantum Physics Ⅱ<br>양자물리학 Ⅱ | 3-3-0 | Prerequisite: PHY301 | 2 |
| | PHY307 | Physics Lab Ⅱ<br>물리학실험 Ⅱ | 3-1-4 | Prerequisite:<br>PHY101, PHY103 | 1 |
| | PHY311 | Computational Physics[2]<br>전산물리학 | 3-3-0 | | 2 |
| | PHY313 | Mathematical Physics<br>수리물리학 | 3-3-0 | Prerequisite:<br>PHY201, PHY203 | 1 |
| **Total Credit** | | | **24** | | |

1) This course is counted as required only for students entering from year 2019 and later.
2) This course has been changed from first semester to second semester.

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| PHY | PHY208 | Network Science for Complex Systems<br>복잡계 네트워크 사이언스 개론 | 3-3-0 | | 2 |
| | PHY315 | Solid State Physics Ⅰ<br>고체물리학 Ⅰ | 3-3-0 | Prerequisite: PHY301 | 2 |
| | PHY321 | Optics<br>광학 | 3-3-0 | Prerequisite: PHY204 | 2 |
| | PHY333 | Astrophysics : Stars and Blackholes<br>천체물리학 : 항성과 블랙홀 | 3-3-0 | | 1 |
| | PHY334 | Astrophysics : Galaxies and the Universe<br>천체물리학 : 은하와 우주 | 3-3-0 | | - |
| | PHY407 | Semiconductor and Precision Measurement Physics<br>반도체 및 계측 물리학 | 3-2-2 | | 1 |
| | PHY415 | Solid State Physics Ⅱ : Quantum Material<br>고체물리학 Ⅱ : 양자물성 | 3-3-0 | | 1 |
| | PHY418 | Polymer and Soft Matter Physics<br>고분자 및 연성물질물리학 | 3-3-0 | Prerequisite: PHY303 | 2 |
| | PHY425 | Atomic and Molecular Physics<br>원자 및 분자물리학 | 3-3-0 | | - |
| | PHY427 | Introduction to Plasma Physics<br>플라즈마 물리학 입문 | 3-3-0 | | - |
| | PHY428 | Introduction to Beam Physics<br>빔 물리학 입문 | 3-3-0 | | - |
| | PHY429 | Nuclear and Elementary Particle Physics<br>핵 및 입자물리학 | 3-3-0 | | - |
| | PHY435 | Biological Physics<br>생물물리학 | 3-3-0 | | 1 |
| | PHY437 | Nonlinear Dynamics<br>비선형동역학 | 3-3-0 | | - |
| | PHY439 | Introduction to Modern Theoretical Physics<br>현대이론물리학 입문 | 3-3-0 | Prerequisite: PHY313 | 1 |
| | PHY441 | Fluid Physics<br>유체물리학 | 3-3-0 | | 2 |
| | PHY471 | Special Topics in Physics Ⅰ<br>물리학 특강 Ⅰ | 3-3-0 | | - |
| | PHY472 | Special Topics in Physics Ⅱ<br>물리학 특강 Ⅱ | 3-3-0 | | - |
| | PHY473 | Special Topics in Physics Ⅲ<br>물리학 특강 Ⅲ | 3-3-0 | | - |
| MTH | MTH204 | Linear Algebra<br>선형대수학 | 3-3-0 | Prerequisite: MTH201, MTH203 | 2 |
| | MTH251 | Mathematical Analysis Ⅰ<br>해석학 Ⅰ | 3-3-0 | | 1 |
| | MTH271 | Methods of Applied Mathematics<br>응용수학방법론 | 3-3-0 | Recommended course: MTH203 | - |
| | MTH313 | Complex Analysis Ⅰ<br>복소해석학 Ⅰ | 3-3-0 | Recommended Course: MTH251 | 1 |
| | MTH321 | Numerical Analysis<br>수치해석학 | 3-3-0 | Prerequisite: MTH201, MTH203 | 2 |
| | MTH333 | Scientific Computing<br>과학계산 | 3-3-0 | | - |
| | MTH361 | Mathematical Modeling and Applications<br>수리모형방법론 | 3-3-0 | Prerequisite: MTH201, MTH203 | 1 |
| MEN | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| NSE | NSE351 | Introduction to plasma kinetic theory and nonlinear physics<br>플라즈마운동이론기초 | 3-3-0 | | 2 |
| AMS | AMS230 | Introduction to Crystallography<br>결정학개론 | 3-3-0 | Prerequisite: AMS202 or SCM202 | 2 |
| | AMS431 | Magnetic Properties of Materials<br>재료의 자기적 성질 | 3-3-0 | | 1 |
| EE | EE342 | Microwave Engineering<br>마이크로파공학 | 3-3-0 | Prerequisite: EE201, EE231 | 2 |
| | EE432 | Optoelectronics<br>광전자공학 | 3-3-0 | | 1 |
| CSE | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| BME | BME203 | Introduction to Bioinformatics<br>생물정보학 개론 | 3-3-0 | | - |
| | BME319 | Optical Imaging<br>광학이미징 | 3-3-0 | | 1 |
| | BME321 | Introduction to Biomedical Optics<br>의광학 개론 | 3-3-0 | | 2 |
| **Total Credit** | | | **111** | | |

## ☐ Chemistry (CHEM)

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CHEM | CHM201 | Organic Chemistry Lab<br>유기화학실험 | 2-0-4 | | 2 |
| | CHM211 | Organic Chemistry Ⅰ<br>유기화학 Ⅰ | 3-3-0 | Identical: ACE201, ENE211 | 1 |
| | CHM212 | Organic Chemistry Ⅱ<br>유기화학 Ⅱ | 3-3-0 | Identical: ACE202, ENE221 | 2 |
| | CHM231 | Physical Chemistry Ⅰ<br>물리화학 Ⅰ | 3-3-0 | Identical: ACE203, ENE212 | 1 |
| | CHM232 | Physical Chemistry Ⅱ<br>물리화학 Ⅱ | 3-3-0 | | 2 |
| | CHM291 | Analytical Chemistry Ⅰ<br>분석화학 Ⅰ | 3-3-0 | Identical: ENE213 | 1 |
| | CHM301 | Inorganic Chemistry Lab<br>무기화학실험 | 2-0-4 | | 1 |
| | CHM302 | Physical/Analytical Chemistry Lab<br>물리분석화학실험 | 2-0-4 | | 2 |
| | CHM321 | Biochemistry Ⅰ<br>생화학 Ⅰ | 3-3-0 | Identical: BIO211 | 1 |
| | CHM351 | Inorganic Chemistry Ⅰ<br>무기화학 Ⅰ | 3-3-0 | Identical: ACE304, ENE311 | 1 |
| | CHM352 | Inorganic Chemistry Ⅱ<br>무기화학 Ⅱ | 3-3-0 | Identical: ACE326, ENE326 | 2 |
| | CHM391 | Instrumental Analysis<br>기기분석 | 3-3-0 | Identical: ACE391, ENE322 | 2 |
| **Total Credit** | | | **33** | | |

* From 2019 entrants, both CHM301 and CHM302 are required.



### ▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CHEM | CHM311 | Synthetic Organic Chemistry<br>합성유기화학 | 3-3-0 | | 1 |
| | CHM313 | Fundamental of Energy Materials<br>에너지재료개론 | 3-3-0 | Identical: ENE317 | 1 |
| | CHM322 | Biochemistry Ⅱ<br>생화학 Ⅱ | 3-3-0 | Identical: BIO221 | 2 |
| | CHM323 | Medicinal Chemistry<br>의약화학 | 3-3-0 | Prerequisite:<br>CHM211, CHM212 | 2 |
| | CHM324 | Spectroscopy in Organic Chemistry<br>유기분광학 | 3-3-0 | | 2 |
| | CHM333 | Physical Chemistry Ⅲ<br>물리화학 Ⅲ | 3-3-0 | | 1 |
| | CHM335 | Quantum Chemistry<br>양자화학 | 3-3-0 | | 1 |
| | CHM336 | Chemical Thermodynamics<br>화학열역학 | 3-3-0 | | - |
| | CHM337 | Computational Chemistry<br>전산화학 | 3-3-0 | | 2 |
| | CHM371 | Introduction to Nanochemistry<br>나노화학개론 | 3-3-0 | Identical: ACE416, ENE416 | 2 |
| | CHM372 | Introduction to Polymer Chemistry<br>고분자화학개론 | 3-3-0 | Identical: ACE351, ENE226, AMS270 | 2 |
| | CHM401 | Special Topics in Chemistry Ⅰ<br>화학특론 Ⅰ | 3-3-0 | | - |
| | CHM402 | Special Topics in Chemistry Ⅱ<br>화학특론 Ⅱ | 3-3-0 | | - |
| | CHM403 | Special Topics in Chemistry Ⅲ<br>화학특론 Ⅲ | 3-3-0 | | - |
| | CHM421 | Introduction to Chemical Biology<br>화학생물학개론 | 3-3-0 | | 2 |
| | CHM422 | Introduction to Supramolecular Chemistry<br>초분자화학개론 | 3-3-0 | | 1 |
| | CHM431 | Introduction to Molecular Spectroscopy<br>기초분자분광학 | 3-3-0 | | 2 |
| | CHM433 | Solid State Physical Chemistry<br>고체물리화학 | 3-3-0 | | - |
| | CHM451 | Inorganic Materials Analysis<br>무기재료분석 | 3-3-0 | | 2 |
| | CHM452 | Organometallic Chemistry<br>유기금속화학 | 3-3-0 | | 1 |
| | CHM453 | Bioinorganic Chemistry<br>생무기화학 | 3-3-0 | | - |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| CHEM | CHM454 | Solid State Chemistry<br>고체화학 | 3-3-0 | Identical: ACE321, ENE313 | - |
| | CHM455 | Crystallography<br>결정학 | 3-3-0 | | 2 |
| | CHM471 | Block Copolymers<br>블록 코폴리머 | 3-3-0 | | 1 |
| | CHM473 | Nanomaterials Chemistry<br>나노재료화학 | 3-3-0 | | - |
| | CHM474 | Advanced Polymer Chemistry<br>고급고분자화학 | 3-3-0 | | 1 |
| PHY | PHY201 | Classical Mechanics Ⅰ<br>고전역학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY203 | Electromagnetism Ⅰ<br>전자기학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY204 | Electromagnetism Ⅱ<br>전자기학 Ⅱ | 3-3-0 | Prerequisite: PHY203 | 2 |
| | PHY301 | Quantum Physics Ⅰ<br>양자물리학 Ⅰ | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY302 | Quantum Physics Ⅱ<br>양자물리학 Ⅱ | 3-3-0 | Prerequisite: PHY301 | 2 |
| | PHY303 | Thermal and Statistical Physics<br>열 및 통계물리학 | 3-3-0 | Prerequisite: PHY101, PHY103 | 2 |
| | PHY311 | Computational Physics<br>전산물리학 | 3-3-0 | | 2 |
| | PHY313 | Mathematical Physics<br>수리물리학 | 3-3-0 | Prerequisite: PHY201, PHY203 | 1 |
| | PHY315 | Solid State Physics<br>고체물리학 | 3-3-0 | Prerequisite: PHY301 | 2 |
| | PHY321 | Optics 광학 | 3-3-0 | Prerequisite: PHY204 | 2 |
| | PHY415 | Solid State Physics Ⅱ : Quantum Material<br>고체물리학 Ⅱ : 양자물성 | 3-3-0 | | 1 |
| | PHY425 | Atomic and Molecular Physics<br>원자 및 분자물리학 | 3-3-0 | | - |
| | PHY435 | Biological Physics<br>생물물리학 | 3-3-0 | | 1 |
| MTH | MTH313 | Complex Analysis Ⅰ<br>복소해석학 Ⅰ | 3-3-0 | Recommended Course: MTH251 | 1 |
| | MTH420 | Fourier Analysis<br>푸리에 해석학 | 3-3-0 | Prerequisite: MTH251<br>Recommended Course: MTH313 | 2 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| ENE | ENE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ACE312 | 2 |
| | ENE413 | Introduction to New Energy Conversion and Storage<br>신에너지 변환 및 저장 개론 | 3-3-0 | | 2 |
| ACE | ACE312 | Electrochemistry<br>전기화학 | 3-3-0 | Identical: ENE312 | 1 |
| | ACE240 | Engineering Biochemistry<br>공학생화학 | 3-3-0 | | 2 |
| | ACE431 | Introduction to Catalysis<br>촉매개론 | 3-3-0 | | 1 |
| ESE | ESE202 | Environmental Chemistry<br>환경화학 | 3-3-0 | | 1 |
| | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| BIO | BIO201 | Molecular Biology<br>분자생물학 | 3-3-0 | | 2 |
| | BIO231 | The Chemical Basis of Life<br>생명현상의 화학적 이해 | 3-3-0 | | 2 |
| | BIO304 | Current Topics in Biological Sciences<br>현대생명과학동향 | 2-2-0 | | 1 |
| **Total Credit** | | | **152** | | |

## □ Mathematical Sciences (MTH)

※ For only 1st track students, up to 6 credits can be taken from outside mathematical sciences.

### ▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MTH | MTH251 | Mathematical Analysis Ⅰ<br>해석학 Ⅰ | 3-3-0 | | 1 |
| | MTH302 | Modern Algebra Ⅰ<br>현대대수학 Ⅰ | 3-3-0 | Recommended Course*: MTH230 | 1 |
| | MTH313 | Complex Analysis Ⅰ<br>복소해석학 Ⅰ | 3-3-0 | Recommended Course: MTH251 | 1 |
| | MTH351 | General Topology<br>위상수학 | 3-3-0 | Prerequisite: MTH251<br>Recommended Course: MTH230 | 2 |
| **Total Credit** | | | **12** | | |

* It is highly recommended to register the subject related to academic connectivity.

▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MTH | MTH204 | Linear Algebra<br>선형대수학 | 3-3-0 | Prerequisite: MTH201, MTH203 | 2 |
| | MTH252 | Mathematical Analysis II<br>해석학 II | 3-3-0 | Prerequisite: MTH203, MTH251 | 2 |
| | MTH315 | Ordinary Differential Equations<br>상미분방정식론 | 3-3-0 | Prerequisite: MTH201, MTH203 | 2 |
| | MTH321 | Numerical Analysis<br>수치해석학 | 3-3-0 | Prerequisite: MTH201, MTH203 | 2 |
| | MTH342 | Probability<br>확률론 | 3-3-0 | | 2 |
| | MTH413 | Differential Geometry I<br>미분기하학 I | 3-3-0 | | 1 |
| | MTH421 | Introduction to Partial Differential Equations<br>편미분방정식개론 | 3-3-0 | Prerequisite: MTH201, MTH203<br>Recommended Course: MTH315, MTH251 | 1 |
| **Total Credit** | | | **21** | | |

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MTH | MTH230 | Set Theory<br>집합론 | 3-3-0 | | 1 |
| | MTH260 | Elementary Number Theory<br>정수론 | 3-3-0 | | 2 |
| | MTH271 | Methods of Applied Mathematics<br>응용수학방법론 | 3-3-0 | Recommended course: MTH203 | - |
| | MTH281 | Discrete Mathematics<br>이산수학 | 3-3-0 | | - |
| | MTH303 | Modern Algebra II<br>현대대수학 II | 3-3-0 | Prerequisite: MTH302 | 2 |
| | MTH314 | Complex Analysis II<br>복소해석학 II | 3-3-0 | Prerequisite: MTH313<br>Recommended Course: MTH251, MTH252 | 2 |
| | MTH330 | Introduction to Geometry<br>기하학 개론 | 3-3-0 | | - |
| | MTH333 | Scientific Computing<br>과학계산 | 3-3-0 | | - |
| | MTH343 | Financial Mathematics<br>금융수학 | 3-3-0 | | 1 |
| | MTH344 | Mathematical Statistics<br>수리통계학 | 3-3-0 | | - |
| | MTH361 | Mathematical Modeling and Applications<br>수리모형방법론 | 3-3-0 | Prerequisite: MTH201, MTH203 | 1 |
| | MTH412 | Dynamical Systems<br>동적 시스템 | 3-3-0 | Prerequisite: MTH251 | 1 |
| | MTH414 | Differential Geometry II<br>미분기하학 II | 3-3-0 | Prerequisite: MTH413 | - |
| | MTH420 | Fourier Analysis<br>푸리에 해석학 | 3-3-0 | Prerequisite: MTH251<br>Recommended Course: MTH313 | 2 |
| | MTH432 | Algebraic Topology<br>대수위상 | 3-3-0 | Prerequisite: MTH112, MTH351<br>Recommended Course: MTH302 | - |
| | MTH461 | Stochastic Processes<br>확률과정론 | 3-3-0 | Prerequisite: MTH342 | - |
| | MTH480 | Topics in Mathematics I<br>수학 특강 I | 3-3-0 | | - |
| | MTH481 | Topics in Mathematics II<br>수학 특강 II | 3-3-0 | | - |
| PHY | PHY201 | Classical Mechanics I<br>고전역학 I | 3-3-0 | Prerequisite: PHY101, PHY103 | 1 |
| | PHY313 | Mathematical Physics<br>수리물리학 | 3-3-0 | Prerequisite: PHY201, PHY203 | 1 |
| | PHY437 | Nonlinear Dynamics<br>비선형동역학 | 3-3-0 | | - |
| MAE | MEN220 | Fluid Mechanics<br>유체역학 | 3-3-0 | | 2 |
| | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 2 |
| | MEN302 | Introduction to Finite Element Method<br>유한요소법개론 | 3-3-0 | Prerequisite: MEN230 | 2 |
| CSE | CSE232 | Discrete Mathematics<br>이산수학 | 3-3-0 | | 1,2 |
| | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| FIA | FIA331 | Introduction to Financial Engineering<br>금융공학개론 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA404 | Risk Management<br>리스크관리 | 3-3-0 | Prerequisite: MGT207 | 2 |
| MGE | MGE201 | Operations Research I<br>계량경영학 I | 3-3-0 | | 2 |
| | MGE412 | Advanced Investment Science<br>고급계량투자론 | 3-3-0 | Prerequisite: MGE205 | - |
| **Total Credit** | | | **90** | | |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| PHY | PHY336 (Elective)<br>Physical Models of Life<br>생명현상의 물리학적 모형 | ⇨ | <Abolished> |
| | <New> | ⇨ | PHY208 (Elective)<br>Network Science for Complex Systems<br>복잡계 네트워크 사이언스 개론 |

## 5. Course Descriptions

### □ Physics (PHY)

#### PHY201 Classical Mechanics I [고전역학 I]

This course is the first half of one-year classical mechanics course. The course in part aims at training students with mathematical techniques for physics study, thus coordinate systems and vectors are revisited using physicist's language. It covers various aspects of the Newtonian mechanics, including kinematics, oscillation and gravity. Variational principles and Lagrangian dynamics are introduced, and its connection to quantum mechanics and relativity is discussed.

#### PHY202 Classical Mechanics II [고전역학 II]

This course is the second half of one-year classical mechanics course. It covers Hamiltonian dynamics, rigid body, angular motions, coupled oscillations and continuous systems including waves. The course in part aims at training students with mathematical techniques for physics study, thus the methods of finding principle moment of inertia and normal modes are described using physicist's language.

#### PHY204 Electromagnetism II [전자기학 II]

This course is the second half of the one-year electromagnetism course. The subjects covered are theories related to time-varying electromagnetic waves such as Maxwell’s equations, wave equation, reflection and refraction of electromagnetic waves at the boundary of dielectric materials. Transmissions of electromagnetic waves in guided structures are discussed. Gauge transformations, special relativity, and radiation of electromagnetic fields are also introduced.

#### PHY207 Physics Lab I [물리학실험 I]

This course provides hands-on experience on the experimental physics. The purpose of the course is to deepen basic physical concepts by means of measurement and observation of physical phenomena.



#### PHY213 Modern Physics [현대물리학]

This course provides an overview of the two pillars of modern physics: special/general theory of relativity and quantum theory of light and matter. It is intended to bridge between General Physics (PHY101) and higher undergraduate physics courses, featuring logical connection between classical mechanics and electromagnetism to their modern counterparts. The key concepts to be covered include Lorentz transformation, equivalence principle, wave-particle duality, Planck's law of electromagnetic radiation, Schrödinger equation, uncertainty principle, electronic band structure, LASER, and so forth. Special emphasis will be placed on the close interplay between fundamental physics and technological applications.

#### PHY208 Network Science for Complex Systems [복잡계 네트워크 사이언스 개론]

This course provides an introduction to basic concepts and essential methods of the emerging “network science” required for understanding complex systems in general. The course is organized in two parts. The first half will review the conceptual tools and useful heuristics, including the basics of probability, statistics and graph theory in concrete examples. The latter half covers the methods and basic tools for the collecting, curating, and presenting empirical big data. A special emphasis is on the networks and systems approach to complex systems ranging from intracellular reaction networks to social and ecological networks. Throughout the course lectures are combined with hands-on sessions that will improve the literacy in complex systems. Knowledge of programming language may be beneficial but not required. No prerequisites.

#### PHY301 Quantum Physics I [양자물리학 I]

This course is the first half of one-year quantum mechanics course. It covers the experimental basis of quantum mechanics and its general formalism such as wave mechanics, Schrodinger equation, uncertainty principle, and Hilbert space. Students also learn about harmonic oscillator, angular momentum, spin, time-independent perturbation theory, and hydrogen atom.

#### PHY302 Quantum Physics II [양자물리 II]

This course is the second half of one-year quantum mechanics course. It deals with variational and WKB methods, He atom, charged particles in magnetic field, time-dependent perturbation theory, scattering, and Dirac equation, which are the key quantum mechanical phenomena in modern physics.

#### PHY303 Thermal and Statistical Physics [열 및 통계물리학]

This course is intended to provide science/engineering majors with the basic concepts of equilibrium thermodynamics as an analytical tool. The course will cover the fundamental laws of thermodynamics in relation to the free energy and phase transition with particular emphasis on the modern statistical interpretation of classical thermodynamic concepts. Applications in condensed matter and biophysical systems will provide a starting point for advanced studies in statistical physics and interdisciplinary research.

#### PHY307 Physics Lab II [물리학실험 II]

This course provides hands-on experience on the experimental physics. Students will learn advanced experiments which led to development of modern physics. The experimental set-ups are from a variety

of physics fields such as optics, astrophysics, condensed matter physics and beam physics, etc, which basically cover modern physics. The course will deepen students' understanding of physical concepts and its applications.

### PHY311 Computational Physics [전산물리학]
Computational physics is the study and implementation of numerical algorithms to solve problems in physics for which a quantitative theory is available. This course will start from the introduction of basic computational tools, and such tools will be used to develop computational analysis of a few sample problems including solutions of partial differential equations, Monte-Carlo simulations, molecular dynamics simulations, Fourier transforms, etc.

### PHY313 Mathematical Physics [수리물리학]
The main objective of this course is to provide students with a repertoire of mathematical methods which are essential to the solution of problems encountered in the fields of Physics and Applied Physics. The contents will include probability and statistics, calculus of variations, partial differential equations, integral transforms, functions of complex variables. The student will demonstrate understanding of the methods by solving problems assigned as homeworks and given on the written examinations.

### PHY315 Solid State Physics I [고체물리학 I]
This course is the first half of one-year introductory course to solid state physics course. This course covers crystal structure, lattice vibration, free electron theory in metals, the quantum electron theory and the concept of band theory, and electron transport in metal/semiconductor/insulator.

### PHY321 Optics [광학]
This course provides undergraduate level topics in modern optics advanced from the basic knowledge of electromagnetic wave. This course begins with classical geometrical optics including ray-tracing, aberration, lens, mirros, and so on and then covers wave optics reviewing basic electrodynamics and including topics such as polarization, interference, wave guiding, Fresnel and Fraunhofer diffraction, and so on. Some topics in instrumentation and experiments are covered as well.

### PHY333 Introduction to Astrophysics : Stars and Blackholes [천체물리학 : 항성과 블랙홀]
In astrophysics, observed astronomical phenomena are described with physics of various fields. This course introduces in topical fashion astrophysics of astronomical phenomena such as formation, evolution and structure of stars, and properties of compact objects such as white dwarfs, neutron stars and black holes.

### PHY334 Introduction to Astrophysics : Galaxies and the Universe [천체물리학 : 은하와 우주]
In astrophysics, observed astronomical phenomena are described with physics of various fields. This course introduces in topical fashion astrophysics of astronomical phenomena such as nature and origin of galaxies, the large scale structure of the universe, and cosmology.



### PHY407 Semiconductor and Precision Measurement Physics [반도체 및 계측 물리학]
This course is designed to provide an introduction to the electronics and measurement techniques used for various experiments in scientific and engineering fields. The topics covered include basics on electronics network theory, passive circuits, semiconductor diodes and transistors, operational amplifiers, and computer data acquisitions. Several essential elements for ultra-low noise electrical measurements including signal averaging, synchronous and lock-in detection, single electron transistors, SQUID sensors, etc. are also discussed.

### PHY415 Solid State Physics II [고체물리학 II]
This course is the second of one-year introductory course to solid state physics course. This course covers ordered and disordered states, such as ferroelectricity, magnetism, point defect, interface physics and dislocation, in the solid.

### PHY418 Polymer and Soft Matter Physics [고분자 및 연성물질 물리학]
Soft matter, often called complex fluids, is a group of materials which have structures much larger than atomic or molecular scale, and they are easily deformed by thermal stresses or fluctuations. Colloids, polymers, surfactants, emulsions, foams, gels, granular materials, and a number of biological materials are examples of soft matter. In this course, students will learn the general macroscopic physical properties of soft matters and their microscopic origins. The universal static and dynamic properties of polymers and their statistical mechanical analysis will be one of the major topics.

### PHY425 Atomic and Molecular Physics [원자 분자 물리학]
This course starts with the most direct and concrete application of quantum mechanics to a realistic system. It covers electronic structure, electronic transitions, and excited states of hydrogenic and multi-electron atoms. Bond mechanisms between atoms, such as ionic bonds and covalent bonds are introduced and placed on the foot of quantum mechanics and theories of electronic structures. Vibrational and rotational structure is treated, and some introductions to polyatomic molecules and solid structure are also discussed.

### PHY427 Introduction to Plasma Physics [플라즈마 물리 입문]
This course introduces basic plasma and charged particle phenomena that cover fusion plasmas, microwave sources, accelerators, and astrophysical plasmas. It provides basic understanding of charged particle motion under various electromagnetic environments. Basic fluid dynamics, waves in plasmas, and diffusion and sheaths are described. Plasma diagnostics and fusion plasmas are also introduced.

### PHY428 Introduction to Beam Physics [빔 물리학 입문]
This course introduces the theory and application of charged particle beams that cover microwave sources, particle accelerators, and laser-plasma interactions. It provides basic understanding of charged particle motions under various electromagnetic environments such as magnets, RF cavities, and plasmas. Transverse beam optics, acceleration and longitudinal motion, collective description of beam distributions, and interaction

between the beam and the EM fields are reviewed within the context of classical physics. Advanced concepts for beam generation and acceleration, and high frequency EM wave generation are also introduced.

### PHY429 Nuclear & Elementary Particle Physics [핵 및 입자물리학]

This course covers introductory topics of nuclear and particle physics at the undergraduate level. The topics of nuclear physics include scattering theory, structure of nuclei, nuclear models, nuclear reactions, and so on. Particle physics deals with more fundamental particles that constitute nuclei and the primary topic of particle physics is so called standard model that includes fundamental particles such as quarks and leptons and fundamental interactions among those particles such as electro-weak and strong interactions (QED: quantum electrodynamics and QCD: quantum chromodynamics, respectively). The particle physics part of this course covers the basics of the standard model.

### PHY431 General Relativity and Cosmology [일반상대론 및 우주론]

This course begins with a brief review of special relativity as a basis for general relativity and covers basic mathematical tools for general relativity such as tensor algebra and introductory differential geometry. Then, basic formalism of general relativity is developed. Modern cosmology is based upon general relativity and so recent observations and theoretical developments of modern cosmology are introduced based upon general relativity. Some astrophysical topics such as gravitational waves and blackholes are also covered.

### PHY435 Biological Physics [생물물리학]

This course outlines the physical aspects of life phenomena ranging from the population genetics down to the molecular biology. Students will be introduced to the theoretical and experimental tools based on the fundamental notions of electrostatics and statistical mechanics. Key chapters include random walks, diffusion, structure and dynamics of macromolecules, cellular information processing, and other selected topics. Throughout the chapters, students will learn how those methodologies have been successfully applied to solve variety of biological problems and thus critically assess the power and limitations of modern tools for biophysics research. Acquaintance with basic biological concepts will be helpful but not required.

### PHY437 Nonlinear Dynamics [비선형동역학]

This is an introductory course for the nonlinear dynamics and chaos. This course stresses analytical methods, concrete examples and geometric intuition. The theory is developed systematically, starting with first-order differential equations and their bifurcations, followed by phase plane analysis, limit cycles and their bifurcations, and culminating with the Lorenz equations, chaos, iterated maps, period doubling, renormalization, fractals, and strange attractors. The course will also cover some applications of nonlinear dynamics, such as mechanical vibrations, lasers, biological rhythms, superconducting circuits, insect outbreaks, chemical oscillators, genetic control systems, chaotic waterwheels, and even a technique for using chaos to send secret messages.



### PHY439 Introduction to Modern Theoretical Physics [현대이론물리학 입문]

This course provides an overview of modern theoretical methods developed during the 20th century. It starts from special relativity with modern tensor notation and quantum mechanics including Dirac equation and path integral formalism. After introducing classical field theory, non-relativistic and relativistic quantum fields and their canonical quantization methods are discussed. Gauge theory and Feynman diagram are covered in their elementary level.

### PHY441 Fluid Physics [유체물리학]

Static and dynamic properties of fluids will be introduced with the various physical phenomena in fluid flow. Attending the course will improve the ability of the students in understanding and applying the physical properties of flow by introducing many examples which we can see in everyday life.

### PHY471~3 Special Topics in PHY Ⅰ ~ Ⅲ [물리학특강 Ⅰ ~ Ⅲ]

This course introduces new research topics in the field of Physics.

## □ Chemistry (CHEM)

### CHM201 Organic Chemistry Lab [유기화학실험]

This is a lab session of 2nd year organic chemistry courses, which covers basic organic transformations, purifications, and characterisations of organic compounds. The lab sessions provide basic knowledge and skills for simple reactions in organic chemistry. Safety will be a high priority.

### CHM211 Organic Chemistry Ⅰ [유기화학 Ⅰ]

This class is an introduction to the classification, structure, and reaction mechanism of organic compounds. The class is set up so that, upon completion, students will understand the different characteristics of organic compounds, including their classification, structure, nomenclature, reaction mechanisms, and synthesis.

### CHM212 Organic Chemistry Ⅱ [유기화학 Ⅱ]

This is a continuation of lectures in a two-semester organic chemistry course that is being offered to introduce students to the comprehensive principles of organic chemistry and to communicate the excitement of scientific discovery. The basic objective of Organic Chemistry 2 is to continue to lay a solid organic chemistry foundation for further studies in chemistry and related fields.

### CHM231 Physical Chemistry Ⅰ [물리화학 Ⅰ]

This essential course is for undergraduate students who are interested in chemistry and chemistry-related fields. The course is designed to build basic physical concepts for fundamental understanding of equilibria in chemistry. Equilibria include physical change, such as fusion and vaporisation, and chemical change including electrochemistry. The details cover classical thermodynamics, particularly in terms of enthalpy and

entropy. The students are expected to obtain a unified view of equilibrium and the direction of spontaneous change under the chemical potentials of bulk substances.

### CHM232 Physical Chemistry II [물리화학 II]

A series of lectures on quantum chemistry is provided in this course. In the introductory part, lectures introduce the history of quantum mechanics including blackbody radiation, Planck's hypothesis, and Schrodinger equation. Basic concepts required for understanding quantum chemistry, such as discontinuity of energy states, wave function, and uncertainty principle are covered in the beginning of the course. Principles and applications of various spectroscopic techniques incorporating electronic, vibrational, rotational, and Raman spectroscopy are described in the following lectures.

### CHM291 Analytical Chemistry I [분석화학 I]

The main purpose of the course is to provide students with a strong theoretical and practical grounding in the principles and practices of analytical chemistry, including classical and instrumental analytical techniques. This introductory course also covers the principles of spectrophotometry and mass spectrometry.

### CHM301 Inorganic Chemistry Lab [무기화학실험]

This is a lab session of 3rd year inorganic chemistry courses, which covers basic synthetic techniques, and characterisations of inorganic compounds. The lab sessions provide basic knowledge and skills for simple reactions in inorganic chemistry.

### CHM302 Physical/Analytical Chemistry Lab [물리분석화학실험]

This experimental course is designed to provide students a chance to experience up-to-date experimental physical chemistry instruments and experimentation as well as state-of-the art analytical instruments to characterise organic, inorganic, and biological molecules and materials.

### CHM311 Synthetic Organic Chemistry [합성유기화학]

This course covers topics on the structure and reactivity of organic molecules with an emphasis on reaction mechanisms. Students will be introduced frontier molecular orbital theory and pericyclic reactions including Diels-Alder reaction, sigmatropic rearrangement, and elecrocyclization. Also, reactivity of various functional groups and stereochemistry of reactions will be discussed. This course recommends prerequisites of Organic Chemistry 1 and 2.

### CHM313 Fundamentals of Energy Materials [에너지재료개론]

This course offers basic understandings and applications of the energy materials related to energy conversion and storage using organic and inorganic materials. It covers the roles of bonding defining the fundamental types of energy materials and structural defects, kinetics, and expands to in-depth understanding of electronic, magnetic materials, and metals and ceramics, glasses and polymers. Finally, this course focuses on the material selection and design for the solar cells, fuel cell, and batteries.



### CHM321 Biochemistry I [생화학 I]

Our body is composed of various biological polymers such as protein, nucleic acid, lipid and glycan. These bio-polymers are composed of many monomer molecules such as amino acids, bases, fatty acids, and various sugar molecules. In this course of Biochemistry 1, students will learn basic biosynthetic mechanism of biopolymers by biological machinery. Biological polymers' structure and cellular functions will be discussed in this course, too. Because key mechanisms in this lecture will be discussed with organic chemistry terms, students are expected to have 2nd-year level knowledge of organic chemistry 1 and 2.

### CHM322 Biochemistry II [생화학 II]

The second part of lecture covers signalling and metabolism of biological systems. Biosynthesis of carbohydrate, proteins, and DNAs will also be discussed. Recent advances in the convergence of biomolecules and nanotechnology will also be introduced.

### CHM323 Medicinal Chemistry [의약화학]

This course covers structures and functions of drug targets including proteins, DNA, and RNA, and their interactions with small organic molecules. These interactions between macromolecules and small molecules serve as the basis for inhibition/activation of their biological functions. Students will also learn the concepts in phamacokinetics, pharmacodynamics, and drug metabolism. The basic processes involved in drug discovery from hit identification to clinical candidates will be covered with case studies on examples of life saving drugs. This course recommends prerequisites of organic chemistry and biochemistry.

### CHM324 Spectroscopy in Organic Chemistry [유기분광학]

This course will provide the students with a fundamental understanding of the theory and practice of common spectroscopic techniques (NMR, IR, UV-vis, and MS) used in the identification of organic compounds. Special emphasis will be given in the application and interpretation of these analytical spectra. Students are expected to have taken ‘Organic Chemistry I’ and ‘Organic Chemistry II’.

### CHM333 Physical Chemistry III [물리화학 III]

Statistical thermodynamics and kinetic theory are the two main topic s of the course. Derivation of the Boltzmann distribution is introduced in the beginning and followed by lectures on basic concepts of statistical thermodynamics such as ensemble, partition function and entropy. In the second half of the course, basic kinetic theory including reaction rate, collision, diffusion, and activated complex theory (Eyring equation) are covered.

### CHM335 Quantum Chemistry [양자화학]

Chemistry is defined as “a science that deals with the composition, structure, and properties of substances and with the transformations that they undergo” (Merriam Webster Dictionary). This course will introduce molecular structure and the important spectroscopic and spectrometric tools for structure analysis of small and large molecules. The kinetics of chemical and physical transformations, as relevant to chemistry and

biology, will be covered in the second part of the course. Modern experiments will be discussed to show capabilities and limits of current spectroscopic technologies.

### CHM336 Chemical Thermodynamics [화학열역학]

Thermodynamics enables us to find an equilibrium phase of materials and to study its physical and chemical properties. This course is intended to study phase equilibria of various systems such as gases and condensed materials involving surfaces. Mainly focusing on practical problems, it can help develop one's confidence and ability to apply thermodynamics in novel situations.

### CHM337 Computational Chemistry [전산화학]

Computational chemistry plays a very important role in chemical researches since it provides in-depth understanding of mysterious chemical properties of molecular systems. This course offersa basic understanding of the role of computational chemistry. Based on physical/chemical principles including quantum mechanics and classical mechanics, this course covers how to calculate electronic structures, spectroscopic properties, thermal properties, and chemical reactions in molecular systems, solid state systems, and biological systems with molecular modeling by using computers.

### CHM351 Inorganic Chemistry I [무기화학 I]

The course is designed for undergraduate students who plan to major in chemistry and materials science and engineering. The objective of this course is to understand basic principles of modern inorganic chemistry. Topics covered in this course include atomic and molecular structures, molecular shape and symmetry, structure of solids, acid-base, oxidation-reduction, and molecular bonding.

### CHM352 Inorganic Chemistry II [무기화학 II]

Electronics structures, spectroscopic and magnetic properties of the coordination compounds will be discussed based on the crystal field theory and molecular orbital theory. In addition to the reactions and properties of the coordination compounds, and the catalytic properties of the organometallic compounds also will be discussed.

### CHM371 Introduction to Nanochemistry [나노화학개론]

This course is intended primarily as an introduction course to nano chemistry for undergraduate students. The objective is to understand basic concepts of nanoscience and nanotechnology from a chemical perspective and introduce general synthesis principles, characterization techniques, and potential technological applications of nanostructured materials. Such issues will be discussed in terms of presently important nano materials, including silica, magnetic, semiconducting, and carbon nanostructures.

### CHM372 Introduction to Polymer Chemistry [고분자화학개론]

This course is designed for undergraduate students who are interested in synthetic and physical chemistry of molecules of high molecular weight. This introductory course covers basic concepts of polymer such as molecular weights and their distribution, synthetic chemistry of various polymerisations, behaviour of polymers in solution and bulk, and physical properties of synthetic macromolecules. Recent developments in synthetic chemistry, a convergence of synthetic and biopolymers, and the fascinating world of applications of polymers will also be introduced. Students are expected to have second-year level knowledge of organic and physical chemistry.

### CHM391 Instrumental Analysis [기기분석]

This course introduces the principles of analytical instruments which are essential for the characterisation of various compounds and materials. The course provides students with the opportunity to learn how to operate them in laboratories. This course deals with many instruments for spectroscopic analysis (NMR, IR, UV-Vis, Raman), x-ray analysis (XRD, XRF), surface analysis (AFM, XPS, SIMS), thermal analysis (DSC, TGA), mass spectrometry, and electron microscopy.

### CHM421 Introduction to Chemical Biology [화학생물학개론]

Chemical biology can be defined as a biological study with chemical approaches. In recent two decades, chemical biology has been expanded to make lots of fascinating discoveries in biological field and some approaches of chemical biology have been essential tools in some biological research field. In this course, we will learn and discuss about concepts, mechanisms and applications of newly developed chemical tools in chemical biology field from current chemical biology research topics such as biological surrogates for glyco- and lipid biology, total protein synthesis, unnatural amino acid polymerisation, biomimetic synthetic enzymes, acitivity-based proteomics, affinity-based inhibitor, protein tagging tools, fluorescent chemical probes. Students are expected to have third year level knowledge of organic chemistry, biochemistry, and cellular biology.

### CHM422 Introduction to Supramolecular Chemistry [초분자화학개론]

Supramolecular chemistry involves the use of non covalent bonding interactions to self-assemble molecules into thermodynamically stable and well-defined structures. The course explores the field of supramolecular chemistry from molecules to nano materials. This course will provide students with an introduction to recent interesting research. The topics tp be covered include the types of non-covalent bonding, molecular recognition, the role of molecular recognition in biological systems, synthesis of new materials through supramolecular chemistry, applications for new nano materials. Students will be introduced to essential background concepts such as types of non covalent bonding and strategies for the design of supramolecular assemblies.

### CHM431 Introduction to Molecular Spectroscopy [기초분자분광학]

This course is designed for undergraduate students who are interested in spectroscopy and experimental physical chemistry. In addition to basic concepts of spectroscopy, this advanced course covers cutting edge spectroscopy which is still under development such as 2D IR, optical force, correlated rotational alignment spectroscopy, and time-resolved electron microscopy and spectroscopy. Students are expected to have second-year levels knowledge of physical and quantum chemistry and spectroscopy.

### CHM433 Solid State Physical Chemistry [고체물리화학]
Technologically important nanomaterials are hardly described by molecular theories. A theory dealing with extended systems is necessary to describe their electronic and structural properties. This course introduces basic knowledge of condensed matter physics to help understand the chemical properties. The main topics to be covered briefly are the lattice energy, band theory, optical properties, electron transport, and so on.

### CHM451 Inorganic Materials Analysis [무기재료분석]
This course covers the principles of analytical instruments which are needed in the characterisation of organic and inorganic materials, and provides students with the opportunity to learn how to operate them in laboratories. This course deals with many instruments for spectroscopic analysis, x-ray analysis, surface analysis, thermal analysis, mass spectrometry, and electron microscopy.

### CHM452 Organometallic Chemsitry [유기금속화학]
The focus of this course is on the synthesis, structure and bonding, properties and reactivity of main group organometallics (including Grignard reagents, organolithium reagents, organophosphorus compounds, etc), organotransition metal chemistry and organometallic catalysis. The course is of particular relevance for students interested in synthetic chemistry.

### CHM453 Bioinorganic Chemistry [생무기화학]
This course covers fundamental principles of inorganic chemistry in the context of the role of metals in biological systems. Special emphasis is put on the role of metals in biological systems, and the connection between fundamental knowledge of biological processes with respect to metals, and their relation to commonly known phenomena such as diseases, pollution, alternative energies, evolution and industrial processes.

### CHM454 Solid State Chemistry [고체화학]
This course focuses on the basic principles of solid state chemistry. Structural, chemical, and physical aspects of inorganic solids, such as ionic solids, metal, and molecular solids, will be discussed. The course explores the relationship between electronic structure, chemical bonding, and atomic order. It also investigates the characterization of atomic arrangements in crystalline and amorphous solids: metal, ceramics, semiconductors, and polymers. Topics include: symmetry, basic crystallography, crystal structure, bonding in solids, characterization technique (X-ray diffraction, microscopy, and spectroscopy) and crystal defects.

### CHM455 Crytallography [결정학]
This course focuses on the basic principles of solid state chemistry. Structural, chemical, and physical aspects of inorganic solids, such as ionic solids, metal, and molecular solids, will be discussed. The course explores the relationship between electronic structure, chemical bonding, and atomic order. It also investigates the characterization of atomic arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors, and polymers. Topics include: symmetry, basic crystallography, crystal structure, bonding in solids, characterization techniques (X-ray diffraction, microscopy, and spectroscopy) and crystal defects.



### CHM471 Block Copolymers [블록 코폴리머]
Block copolymers are increasingly attracting interest as well-defined architectural polymers. This course delivers fundamentals of synthetic and physical chemistry of block copolymers. Topics to be discusses involves modern controlled polymerisation techniques, phase behaviour of block copolymers, solution physical chemistry, and structure-function relationships. Application of block copolymers to biomedical sciences, pharmaceutics, and nano sciences will also be discussed.

### CHM473 Nanomaterials Chemistry [나노재료화학]
This course introduces basic concepts of nanomaterials and nanochemistry and applications of basic concepts to modern materials for electronics, catalysis, and optics. Inorganic chemistry for synthesis and characterization of 2-D materials will also be covered.

### CHM474 Advanced Polymer Chemistry [고급고분자화학]
This course will provide advanced level topics in Polymer Chemistry including an introduction to Polymer Chemistry. The course is designed to deliver undergraduate/graduate students a comprehensive understanding of the polymer synthesis, the synthetic mechanism, and design strategy for various polymers including vinyl polymers, polyethers, polysulfides, polyesters, polyamides, hetercyclic polymers, inorganic polymers, and miscellaneous organic polymers. Recent synthetic advances in polymer chemistry will be covered as well.

### CHM401~3 Special Topics in Chemisty I~III [화학특론 I~III]
In recent years nanoscience and nanotechnology have grown rapidly. Chemical science, in particular, presents a unique approach to building novel materials and devices with a molecular-scale precision. One can envision the advantages of nanoscale materials and devices in medicine, computing, scientific exploration, and electronics, where nanochemical science offers the promise of building objects atom by atom. This course reviews current developments in chemical science.

## □ Mathematical Sciences (MTH)

### MTH204 Linear Algebra [선형대수학]
More abstract treatment of linear algebra than Linear Algebra (MTH103). Tools such as matrices, vector spaces and linear transformations, bases and coordinates, eigenvalues and eigenvectors and their applications. Characteristic and minimal polynomial. Similarity transformations: Diagonalization and Jordan forms over arbitrary fields. Schur form and spectral theorem for normal matrices. Quadratic forms and Hermitian matrices: variational characterization of the eigenvalues, inertia theorems. Singular value decomposition, generalized inverse, projections, and applications. Positive matrices, Perron-Frobenius theorem. Markov chains and stochastic matrices. M-matrices. Structured matrices (Toeplitz, Hankel, Hessenberg). Matrices and optimization.

### MTH230 Set Theory [집합론]

Set-theoretical paradoxes and means of avoiding them. Sets, relations, functions, order and well-order. Proof by transfinite induction and definitions by transfinite recursion. Cardinal and ordinal numbers and their arithmetic. Construction of the real numbers. Axiom of choice and its consequences.

### MTH251 Mathematical Analysis I [해석학 I]

The real number system. Set theory. Topological properties of R^n, metric spaces. Numerical sequences and series, Continuity, connectedness, compactness. Differentiation and integration.

### MTH252 Mathematical Analysis II [해석학 II]

Sequences and series of functions: Uniform convergence and continuity, Power series, special functions. Functions of several variables: Partial derivatives, Inverse function theorem, Implicit function theorem, transformation of multiple integrals. Integration of Differential forms.

### MTH260 Elementary Number Theory [정수론]

Divisibility, congruences, numerical functions, theory of primes. Topics selected: Diophantine analysis, continued fractions, partitions, quadratic fields, asymptotic distributions, additive problems.

### MTH271 Methods of Applied Mathematics [응용수학방법론]

Concise introductions to mathematical methods for problems formulated in science and engineering. Functions of a complex variable, Fourier analysis, calculus of variations, perturbation methods, special functions, dimension analysis, tensor analysis. Introduction to numerical methods with emphasis on algorithms, applications and computer implementation issues.

### MTH281 Discrete Mathematics [이산수학]

This course introduces discrete objects, such as permutations, combinations, networks, and graphs. Topics include enumeration, partially ordered sets, generating functions, graphs, trees, and algorithms.

### MTH302 Modern Algebra I [현대대수학 I]

Groups, homomorphisms, automorphisms, permutation groups. Rings, ideals and quotient rings, Euclidean rings, polynomial rings. Extension fields, roots of polynomials.

### MTH303 Modern Algebra II [현대대수학 II]

Further topics on groups, rings; the Sylow Theorems and their applications to group theory; classical groups; abelian groups and modules over a principal ideal domain. Algebraic field extensions; splitting fields and Galois theory; construction and classification of finite fields.



### MTH313 Complex Analysis I [복소해석학 I]

Complex numbers and complex functions. The algebra of complex numbers, fractional powers, Logarithm, power, exponential and trigonometric functions. Differentiation and the Cauchy-Riemann equations. Cauchy's theorem and the Cauchy integral formula. Singularities, residues, Taylor series and Laurent series.

### MTH314 Complex Analysis II [복소해석학 II]

Conformal mapping: Fractional Linear transformations. Riemann Mapping Theorem. Analytic continuation. Harmonic functions.Some advanced topics in complex analysis.

### MTH315 Ordinary Differential Equations [상미분방정식론]

Existence and uniqueness of solutions, linear systems, regular singular points. Analytic systems, autonomous systems, Sturm-Liouville Theory.

### MTH321 Numerical Analysis [수치해석학]

Polynomial interpolation, Polynomial approximation, Orthogonal polynomials and Chebyshev polynomials. Least-squares approximations. Numerical differentiation and integration. Numerical methods for solving initial and boundary value problems for ODEs. Direct and iterative methods for solving linear systems. Numerical solutions of Nonlinear system of equations.

### MTH330 Introduction to Geometry [기하학 개론]

A critical examination of Euclid's Elements; ruler and compass constructions; connections with Galois theory; Hilbert's axioms for geometry, theory of areas, introduction of coordinates, non-Euclidean geometry, regular solids, projective geometry.

### MTH331 Scientific Computing [과학계산]

Fundamental techniques in scientific computation with an introduction to the theory and software of the topics. Monte Carlo simulation. Numerical linear algebra. Numerical methods of ordinary and partial differential equations. Fourier and wavelet transform methods. Nonlinear equations. Numerical continuation methods. Optimization. Gas and Fluid dynamics.

### MTH342 Probability [확률론]

Combinatorial analysis used in computing probabilities. The axioms of probability, conditional probability and independence of events. Discrete and continuous random variables. Joint, marginal, and conditional densities and expectations, moment generating function. Laws of large numbers. Binomial, Poisson, gamma, univariate, and bivariate normal distributions. Introduction to stochastic processes.

### MTH343 Financial Mathematics [금융수학]

Review of random variables, expectation, variance, covariance and correlation. Binomial distribution. Properties of Normal random variables and the central limit theorem. Time value of money, compound

interest rates and present value of future payments. Interest income. The equation of value. Annuities. The general loan schedule. Net present values. Comparison of investment projects Option pricing techniques in discrete and continuous time. Black-Scholes option pricing formula.

### MTH344 Mathematical Statistics [수리통계학]
Probability and combinatorial methods. Discrete and continuos univariate and multivariate distributions. Expected values, moments. Estimation. Unbiased estimation. Maximum likelihood estimation. Confidence intervals. Tests of hypotheses. Likelihood ratio test. Nonparametric methods.

### MTH351 General Topology [위상수학]
Set-theoretic preliminaries. Metric spaces, topological spaces, compactness, connectedness. Countability and separation axioms. Covering spaces and homotopy groups.

### MTH361 Mathematical Modeling and Applications [수리모형방법론]
Formulation and analysis of mathematical models. Applications to physics, biology, economics, social sciences and other areas of science. Use of Mathematical and scientific software packages: Mathematica, Matlab, Maple, e.t.c.

### MTH412 Dynamical Systems [동적 시스템]
This course provides tools to characterize qualitative properties of linear and nonlinear dynamical systems in both continuous and discrete time. The course covers stability analysis of differential equations, Hamiltonian systems, Pointcare mapping, and Reduction methods.

### MTH413 Differential Geometry I [미분기하학 I]
The differential properties of curves and surfaces. Introduction to differential manifolds and Riemannian geometry. Second fundamental form and the Gauss map. Vector fields. Minimal surfaces. Isometries. Gauss Theorem and equations of compatibility. Parallel transport, Geodesics and Gauss Bonet theorem. The Exponential map.

### MTH414 Differential Geometry II [미분기하학 II]
Plane curves: rotation index, isoperimetric inequality, Fenchel’s theorem. Space curves: congruence, total curvature of a knot. Submanifolds of Euclidean spaces as level sets, Gauss map. Curves on a surface, geodesics. Gauss Lemma and a proof that geodesics minimise distance locally. Isometries and conformal maps.

### MTH420 Fourier Analysis [푸리에 해석학]
Introduction to harmonic analysis and Fourier analysis methods, such as Calderon-Zygmund theory, Littlewood-Paley theory, and the theory of various function spaces, in particular Sobolev spaces. Some selected applications to ergodic theory, complex analysis, and geometric measure theory will be given.



### MTH421 Introduction to Partial Differential Equations [편미분방정식개론]
Waves and Diffusions. Reflections and Sources. Boundary value problems. Fourier series. Harmonic functions. Green's Identities and Green's functions. Computation of solutions. Waves in space. Boundaries in the plane and in space. General eigenvalue problems. Distributions and Transforms. Nonlinear PDEs.

### MTH432 Algebraic Topology [대수위상]
Fundamental group and covering spaces, simplicial and singular homology theory with applications, cohomology theory, duality theorem. Homotopy theory, fibrations, relations between homotopy and homology, obstruction theory, and topics from spectral sequences, cohomology operations, and characteristic classes.

### MTH461 Stochastic Processes [확률과정론]
Exponential Distribution and Poisson Process. Markov Chains. Limiting Behavior of Markov Chains. The main limit theorem and stationary distributions, absorption probabilities. Renewal theory and its applications. Queueing theory. Reliability theory. Brownian Motion and Stationary Processes. Martingales. Structure of a Markov process: waiting times and jumps. Kolmogorov differential equations.

### MTH480 Topics in Mathematics I [수학 특강 I]
This course is designed to discuss contemporary topics in Mathematics. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MTH481 Topics in Mathematics II [수학 특강 II]
This course is designed to discuss contemporary topics in Mathematics. Actual topics and cases will be selected by the instructor and may vary from term to term.

# School of Business Administration

## 1. School Introduction

The vision of UNIST School of Business Administration (SBA) is to become a world-class business school with an emphasis on technology-based management. We educate students both in technology and management to be creative global business leaders in today's dynamic economy. Being a part of a science and technology university, the SBA offer three undergraduate tracks: 1) Management, 2) Finance & Accounting, and 3) Entrepreneurship. Through these tracks, the SBA courses cover various business areas including Strategic Management, Entrepreneurship, Human Resource and Organization Behavior, Marketing, Information Systems, Finance, Financial Engineering and Accounting. On top of the undergraduate education, we provide graduate-level professional programs in Management of Technology, Business Analytics, Energy Commodity Trading & Financial Engineering, Renewable Energy Technology Management, and Entrepreneurship & Innovation. The SBA faculty also run a graduate program of Management Engineering in which students perform leading-edge business research by combining management/business knowledge and scientific/data-analytic methodologies. In sum, the UNIST SBA aims for a world-class business school that offers undergraduate, graduate, as well as professional business education, presenting a broad spectrum of career opportunities for students.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Management (MGT)

Students in Management Track provide education for the leaders in a highly-globalized business environments with rapid technological and social changes. In order to understand and cope with complicated business environments, students in Management Track learn fundamental areas of business management including Strategic Management, Entrepreneurship, Human Resource and Organizational Behavior, Marketing, Information Systems, Operation Management, as well as Finance and Accounting. Management education helps students to understand corporate and marketing strategy, an organization's design and operations, managerial decision-making process, technical and managerial issues of information technology, and an organization’s economic, legal and ethical environment. Students can acquire knowledge about how to manage an organization and its people in a creative and efficient way as well as how an organization interacts with its environment and participants, including customers, clients, employees, and partners.



#### 2) Finance & Accounting (FIA)

Students in Finance & Accounting are field trained for careers in domestic and international corporations and financial institutions as well as careers in academia. Finance allows students to study the ways in which individuals, corporations, and other business organizations allocate resources and make financial decisions in capital markets. Courses in Finance include Financial Management, Investment Analysis, Money & Banking and Financial Engineering which cover various academic areas as well as practical techniques with both broad and specific perspectives. Accounting helps managers to create and disseminate financial accounting information to communicate effectively with investors and capital market participants, and apply managerial accounting information internally to make more efficient financial and economic decisions. Courses in Accounting include Intermediate Accounting, Managerial Accounting, and Auditing which cover the principles and practices of accounting.

#### 3) Entrepreneurship (EPS)

Entrepreneurship is related not only to the domain of independent new ventures, but also to the long-term viability of extant firms. Organizations are required to be entrepreneurial to survive in the era of globalization in the market and dramatic technological change.
Entrepreneurship allows students to understand the role of entrepreneurship in a fast changing business environment. This track is not only focusing on the issues for the new startups, but also emphasizing the issues for the existing companies. The goal of this track is designed to provide intellectual knowledge as well as real business experience.

### □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| MGT | Required | 21 | 15 | |
| | Elective | 33 | 3 | |
| FIA | Required | 24 | 12 | |
| | Elective | 30 | 6 | |
| EPS[1)] | Required | - | 12 | |
| | Elective | - | 6 | |

1) Students can choose Entrepreneurship track as a 2nd track only.

※ Those students who chose Management track as 1st track and Finance & Accounting as 2nd track must take all the required courses (11 courses–Financial Accounting, Organizational Behavior, Marketing Management, Financial Management, Operations Management, Strategic Management, Dynamics of IT, Investments, Microeconomics and 2 more selective required from FIA) and earn 33 credits. The rest 39 credits can be earned with any courses provided from School of Business Administration.

※ Those students who chose Finance & Accounting track as 1st track and Management as 2nd track must take all the required courses (13 courses–Financial Accounting, Organizational Behavior, Marketing Management, Financial Management, Operations Management, Strategic Management, Dynamics of IT, Investments, Microeconomics and 4 more selective required from FIA) and earn 39 credits. The rest 33 credits can be earned with any courses provided from School of Business Administration.

## 3. Curriculum ※ Opening courses are subject to change

### □ Management (MGT)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGT | MGT202 | Organizational Behavior<br>조직행동론 | 3-3-0 | | 1,2 |
| | MGT204 | Marketing Management<br>마케팅 관리 | 3-3-0 | | 1,2 |
| | MGT205 | Financial Accounting<br>재무회계 | 3-3-0 | | 1,2 |
| | MGT207 | Financial Management<br>재무관리 | 3-3-0 | | 1,2 |
| | MGT308 | Strategic Management<br>경영전략 | 3-3-0 | | 1 |
| **Total Credit** | | | **15** | | |

▶ Required : 1TR / Elective : 2TR

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGT | MGT201 | Dynamics of IT<br>Dynamics of IT | 3-3-0 | | 2 |
| | MGT209 | Operations Management<br>생산운영관리 | 3-3-0 | | 1 |
| **Total Credit** | | | **6** | | |



▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGT | MGT101 | Business Communication & Leadership<br>비즈니스 커뮤니케이션 & 리더십 | 3-3-0 | | 1 |
| | MGT203 | International Business<br>국제경영학 | 3-3-0 | | - |
| | MGT206 | Managerial Accounting<br>관리회계 | 3-3-0 | Prerequisite: MGT205 | - |
| | MGT210 | Data Analysis & Decision Making<br>경영통계 분석 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | MGT211 | Microeconomics<br>미시경제학 | 3-3-0 | Prerequisite: MGT106 | 2 |
| | MGT302 | Human Resource Management<br>인사관리 | 3-3-0 | Prerequisite: MGT202 | - |
| | MGT303 | Strategic Human Resource Management<br>전략적 인적자원 관리 | 3-3-0 | | - |
| | MGT304 | Diversity Management<br>인력 다양성 관리 | 3-3-0 | | - |
| | MGT306 | Business Ethics<br>기업경영 윤리 | 3-3-0 | | - |
| | MGT307 | Legal Environment of Business<br>경영과 법률 환경 | 3-3-0 | | - |
| | MGT312 | Macroeconomics<br>거시경제학 | 3-3-0 | Prerequisite: MGT211 | 1 |
| | MGT315 | Econometrics<br>계량경제학 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | MGT317 | International Economics<br>국제경제학 | 3-3-0 | Prerequisite: MGT312 | 2 |
| | MGT330 | Consumer Behavior<br>소비자행동 | 3-3-0 | Prerequisite: MGT204 | - |
| | MGT331 | International Marketing<br>국제마케팅 | 3-3-0 | Prerequisite: MGT204 | - |
| | MGT332 | Brand Management<br>브랜드관리론 | 3-3-0 | Prerequisite: MGT204 | - |
| | MGT361 | Technology Management<br>기술 경영 | 3-3-0 | | - |
| | MGT362 | Process & Quality Management<br>생산과 품질 관리 | 3-3-0 | Prerequisite: MGT209 | - |
| | MGT363 | Operations Research<br>계량경영학 | 3-3-0 | | - |
| | MGT364 | Database<br>데이터 베이스 | 3-3-0 | | - |
| | MGT366 | Advanced Business Programming<br>고급 경영 프로그래밍 | 3-3-0 | | - |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGT | MGT367 | Data Science for Business<br>비즈니스를 위한 데이터 사이언스 | 3-3-0 | Prerequisite: MTH211 | - |
| | MGT372 | Internet Business and Marketing<br>인터넷 비즈니스 | 3-3-0 | | - |
| | MGT373 | Strategic Management of IT<br>정보기술과 경영전략 | 3-3-0 | | - |
| | MGT410 | Special Topics in MGT Ⅰ<br>MGT 특론 Ⅰ | 3-3-0 | | - |
| | MGT411 | Special Topics in MGT Ⅱ<br>MGT 특론 Ⅱ | 3-3-0 | | - |
| | MGT412 | Special Topics in MGT Ⅲ<br>MGT 특론 Ⅲ | 3-3-0 | | - |
| | MGT413 | Game Theory<br>게임 이론 | 3-3-0 | Prerequisite: MGT211 | - |
| | MGT414 | Special Topics in MGT Ⅳ<br>MGT 특론 Ⅳ | 3-3-0 | | - |
| | MGT432 | Marketing Research<br>마케팅 조사론 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | MGT433 | Advertising Management<br>광고 관리론 | 3-3-0 | Prerequisite: MGT204 | - |
| | MGT441 | Global Business Strategy<br>글로벌경영전략 | 3-3-0 | | - |
| | MGT463 | Simulation<br>시뮬레이션 | 3-3-0 | Prerequisite: MTH211 | - |
| | MGT464 | Stochastic Modeling & Applications<br>추계적 모델링 및 응용 | 3-3-0 | Prerequisite: MTH211 | - |
| | MGT465 | System Analysis and Design<br>경영정보시스템분석 및 설계 | 3-3-0 | | - |
| | MGT466 | Advanced Business Analytics with AI<br>인공지능을 활용한 고급 비즈니스 분석 방법론 | 3-3-0 | Prerequisite: MTH211, MGT367 | - |
| | MGT471 | Managing Innovation and Change<br>혁신과 변화의 관리 | 3-3-0 | | - |
| | MGT473 | Entrepreneurship and Venture Management<br>창업과 벤처 | 3-3-0 | | 1 |
| | MGT474 | Social Entrepreneurship<br>사회적 기업의 창업 | 3-3-0 | | - |
| | MGT491 | Independent Study<br>개별연구 | 3-3-0 | | - |
| | MGT492 | Capstone Projects Ⅰ<br>캡스톤 디자인 Ⅰ | 3-3-0 | | - |
| FIA | FIA301 | Investments<br>투자론 | 3-3-0 | Prerequisite: MTH211 | 2 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| FIA | FIA304 | International Finance<br>국제재무관리 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA305 | Corporate Finance<br>기업재무론 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA431 | Financial Time-series Analysis<br>금융시계열분석 | 3-3-0 | Prerequisite: MTH211 | 2 |
| MGE | MGE207 | Data Science Programming<br>데이터 사이언스 프로그래밍 | 3-3-0 | | 2 |
| | MGE308 | Service Simulation<br>서비스 시뮬레이션 | 3-3-0 | Prerequisite: MGE209 | 2 |
| | MGE362 | Statistical Quality Management*<br>통계적 품질관리 | 3-3-0 | | 1 |
| MTH | MTH342 | Probability<br>확률론 | 3-3-0 | | 2 |
| | MTH343 | Financial Mathematics<br>금융수학 | 3-3-0 | | 1 |
| | MTH461 | Stochastic Processes<br>확률과정론 | 3-3-0 | Prerequisite: MTH342 | - |
| ESE | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| **Total Credit** | | | **174** | | |

## □ Finance & Accounting (FIA)

▶ Required: Core

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| FIA | FIA301 | Investments<br>투자론 | 3-3-0 | Prerequisite: MTH211 | 2 |
| MGT | MGT205 | Financial Accounting<br>재무회계 | 3-3-0 | | 1,2 |
| | MGT207 | Financial Management<br>재무관리 | 3-3-0 | | 1,2 |
| | MGT211 | Microeconomics<br>미시경제학 | 3-3-0 | Prerequisite: MGT106 | 2 |
| **Total Credit** | | | **12** | | |

▶ Required : Selective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| FIA | FIA303 | Futures and Option<br>선물과 옵션 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA305 | Corporate Finance<br>기업재무론 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA331 | Introduction to Financial Engineering<br>금융공학개론 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA332 | Quantitative Finance<br>계량재무론 | 3-3-0 | Prerequisite: MGT207 | 1 |
| | FIA441 | Financial Statement Analysis<br>재무제표분석 | 3-3-0 | Prerequisite: MGT205 | 1 |
| MGT | MGT206 | Managerial Accounting<br>관리회계 | 3-3-0 | Prerequisite: MGT205 | 2 |
| | MGT312 | Macroeconomics<br>거시경제학 | 3-3-0 | Prerequisite: MGT211 | 1 |
| | MGT315 | Econometrics<br>계량경제학 | 3-3-0 | Prerequisite: MTH211 | 1 |
| **Total Credit** | | | **24** | | |

※ Those students who chose FIA track as 1st track must take all the core required courses (4 courses–Investments, Financial Accounting, Financial Management and Microeconomics) and 4 selective required courses on the list above. The selective required courses can be divided to these two fields, 'General Finance' and 'Financial Engineering'. Student can take any courses at least more than 4 courses on the list upon one's interest.

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| FIA | FIA302 | Money and Banking<br>금융시장론 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA304 | International Finance<br>국제재무관리 | 3-3-0 | Prerequisite: MGT207 | 1 |
| | FIA321 | Intermediate Accounting 1<br>중급회계 1 | 3-3-0 | Prerequisite: MGT205 | 1 |
| | FIA322 | Intermediate Accounting 2<br>중급회계 2 | 3-3-0 | Prerequisite: MGT205 | - |
| | FIA402 | Fixed Income Securities<br>채권투자 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA404 | Risk Management<br>리스크관리 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA405 | Corporate Valuation<br>기업가치평가 | 3-3-0 | Prerequisite: MGT205, MGT207 | - |
| | FIA410 | Special Topics in Finance Ⅰ<br>재무특론 Ⅰ | 3-3-0 | | - |
| | FIA411 | Special Topics in Finance Ⅱ<br>재무특론 Ⅱ | 3-3-0 | | - |
| | FIA412 | Special Topics in Accounting Ⅰ<br>회계특론 Ⅰ | 3-3-0 | | - |
| | FIA413 | Special Topics in Accounting Ⅱ<br>회계특론 Ⅱ | 3-3-0 | | - |
| | FIA414 | Applied Investment Management<br>투자실무 | 3-3-0 | Prerequisite: FIA301 | - |
| | FIA415 | Mergers and Acquisitions<br>기업 인수합병론 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA416 | Corporate Governance<br>기업 지배구조론 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA417 | Financial Markets and Trading<br>증권시장론 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA418 | Venture Finance<br>벤처 파이낸스 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA431 | Financial Time-series Analysis<br>금융시계열분석 | 3-3-0 | Prerequisite: MTH211 | 2 |
| | FIA442 | Taxation<br>세무회계 | 3-3-0 | Prerequisite: MGT205 | - |
| | FIA443 | Cost Accounting<br>원가관리전략 | 3-3-0 | Prerequisite: MGT206 | - |
| | FIA445 | Auditing<br>감사학개론 | 3-3-0 | Prerequisite: MGT205 | - |
| | FIA492 | Capstone Projects Ⅰ<br>캡스톤 디자인 Ⅰ | 3-3-0 | | - |
| | FIA493 | Capstone Projects Ⅱ<br>캡스톤 디자인 Ⅱ | 3-3-0 | | - |
| MGT | MGT101 | Business Communication & Leadership<br>비즈니스 커뮤니케이션 & 리더십 | 3-3-0 | | 1 |
| | MGT210 | Data Analysis & Decision Making<br>경영통계 분석 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | MGT306 | Business Ethics<br>기업경영 윤리 | 3-3-0 | | - |
| | MGT307 | Legal Environment of Business<br>경영과 법률 환경 | 3-3-0 | | - |
| | MGT317 | International Economics<br>국제경제학 | 3-3-0 | Prerequisite: MGT312 | 2 |
| | MGT364 | Database<br>데이터베이스 | 3-3-0 | | - |
| | MGT367 | Data Science for Business<br>비즈니스를 위한 데이터 사이언스 | 3-3-0 | Prerequisite: MTH211 | - |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGT | MGT413 | Game Theory<br>게임 이론 | 3-3-0 | Prerequisite: MGT211 | - |
| | MGT466 | Advanced Business Analytics with AI<br>인공지능을 활용한 고급 비즈니스 분석 방법론 | 3-3-0 | Prerequisite: MTH211, MGT367 | - |
| | MGT473 | Entrepreneurship and Venture Management<br>창업과 벤처 | 3-3-0 | | 1 |
| | MGT491 | Independent Study<br>개별연구 | 3-3-0 | | - |
| MGE | MGE207 | Data Science Programming<br>데이터 사이언스 프로그래밍 | 3-3-0 | | 2 |
| MTH | MTH342 | Probability<br>확률론 | 3-3-0 | | 2 |
| | MTH343 | Financial Mathematics<br>금융수학 | 3-3-0 | | 1 |
| | MTH461 | Stochastic Processes<br>확률과정론 | 3-3-0 | Prerequisite: MTH342 | - |
| MEN | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | - |
| CSE | CSE463 | Machine Learning<br>기계학습 | 3-3-0 | Prerequisite: EE211, CSE331 | - |
| ESE | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| Total Credit | | | 129 | | |

## □ Entrepreneurship (EPS)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGT | MGT204 | Marketing Management<br>마케팅 관리 | 3-3-0 | | 1,2 |
| | MGT205 | Financial Accounting<br>재무회계 | 3-3-0 | | 1,2 |
| | MGT308 | Strategic Management<br>경영전략 | 3-3-0 | | 1 |
| | MGT473 | Entrepreneurship and Venture Management<br>창업과 벤처 | 3-3-0 | | 1 |
| Total Credit | | | 12 | | |



▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| EPS | EPS491 | Capstone Projects Ⅰ<br>캡스톤 디자인 Ⅰ | 3-3-0 | | - |
| | EPS492 | Capstone Projects Ⅱ<br>캡스톤 디자인 Ⅱ | 3-3-0 | | - |
| MGT | MGT101 | Business Communication & Leadership<br>비즈니스 커뮤니케이션 & 리더십 | 3-3-0 | | 1 |
| | MGT302 | Human Resource Management<br>인사관리 | 3-3-0 | Prerequisite: MGT202 | - |
| | MGT303 | Strategic Human Resource Management<br>전략적 인적자원 관리 | 3-3-0 | | - |
| | MGT330 | Consumer Behavior<br>소비자행동 | 3-3-0 | Prerequisite: MGT204 | - |
| | MGT361 | Technology Management<br>기술 경영 | 3-3-0 | | - |
| | MGT363 | Operations Research<br>계량경영학 | 3-3-0 | | - |
| | MGT364 | Database<br>데이터 베이스 | 3-3-0 | | - |
| | MGT367 | Data Science for Business<br>비즈니스를 위한 데이터 사이언스 | 3-3-0 | Prerequisite: MTH211 | - |
| | MGT372 | Internet Business and Marketing<br>인터넷 비즈니스 | 3-3-0 | | - |
| | MGT432 | Marketing Research<br>마케팅 조사론 | 3-3-0 | Prerequisite: MTH211 | 1 |
| | MGT465 | System Analysis and Design<br>경영정보시스템분석 및 설계 | 3-3-0 | | - |
| | MGT466 | Advanced Business Analytics with AI<br>인공지능을 활용한 고급 비즈니스 분석 방법론 | 3-3-0 | Prerequisite: MTH211, MGT367 | - |
| | MGT471 | Managing Innovation and Change<br>혁신과 변화의 관리 | 3-3-0 | | - |
| | MGT474 | Social Entrepreneurship<br>사회적 기업의 창업 | 3-3-0 | | - |
| FIA | FIA331 | Introduction to Financial Engineering<br>금융공학개론 | 3-3-0 | Prerequisite: MGT207 | 2 |
| | FIA418 | Venture Finance<br>벤처 파이낸스 | 3-3-0 | Prerequisite: MGT207 | - |
| | FIA441 | Financial Statement Analysis<br>재무제표분석 | 3-3-0 | Prere/quisite: MGT205 | 1 |
| ID | IID232 | 3D CAD<br>3D CAD | 3-2-2 | | 2 |
| | IID404 | Product Service System Design<br>제품서비스시스템디자인 | 3-2-2 | | 1 |
| Total Credit | | | 60 | | |

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| MGT | <New> | ⇨ | MGT367<br>Data Science for business<br>비즈니스를 위한 데이터 사이언스 |
| | <New> | ⇨ | MGT466<br>Advanced Business Analytics with AI<br>인공지능을 활용한 고급 비즈니스 분석 방법론 |
| | MGT209 (Required)<br>Operations Management<br>생산운영관리 | ⇨ | MGT209 (Required : 1TR / Elective : 2TR)<br>Operations Management<br>생산운영관리 |
| | MGT212 (Elective)<br>Business Communication<br>비즈니스커뮤니케이션 | ⇨ | Substitution course: MGT101<br>Business Communication & Leadership<br>비즈니스 커뮤니케이션 & 리더십 |
| | MGT316 (Elective)<br>Industrial Organization<br>산업조직론 | ⇨ | < Closed > |
| | MGT371 (Elective)<br>Service Science<br>서비스 사이언스 | ⇨ | < Closed > |
| | MGT374 (Elective)<br>Mobile Business<br>모바일 비즈니스 | ⇨ | < Closed > |
| | MGT434 (Elective)<br>Experimental design with applications in marketing<br>마케팅실험설계 | ⇨ | < Closed > |
| | MGT435 (Elective)<br>Case studies in marketing<br>마케팅사례연구 | ⇨ | < Closed > |
| | MGT442 (Elective)<br>Case studies in international business<br>국제경영사례연구 | ⇨ | < Closed > |
| FIA | FIA443 (Elective)<br>Strategic Cost Management<br>원가관리 전략 | ⇨ | FIA443<br>Cost Accounting<br>원가관리 전략 |
| | FIA403 (Elective)<br>Derivatives market<br>파생상품시장 | ⇨ | < Closed > |
| | FIA407 (Elective)<br>Case studies in finance<br>재무사례연구 | ⇨ | < Closed > |
| | FIA421 (Elective)<br>Commercial Law<br>상법총론 | ⇨ | < Closed > |



## 5. Course Descriptions

### □ Management (MGT)

**MGT101 Business Communication & Leadership [비즈니스 커뮤니케이션과 리더십]**

This course provides theoretical backgrounds and practical tools for effective management of organization and for improving leadership capability. The main topics include personality, motivation, leadership and team management, organizational design and culture, and organizational change, in both micro and macro perspectives. The purpose of this course is to help prepare students to assume increasingly responsible leadership roles in their personal, professional, and academic lives. As such, the course focuses not only on significant theories of leadership and their applicability to leaders of the past and present, but also includes substantial hands-on, experiential and learning opportunities in which leadership will be put into action.

**MGT201 Dynamics of IT [Dynamics of IT]**

This course introduces business and social applications of information technologies (IT). The main focus of the course is on introducing managerial insights into the strategic use of IT. Students will develop familiarity with the principles of information systems through the analysis of real-world business cases. At the end of the semester, students will be expected to understand technical and strategic foundations for the effective use of information systems in organizations and society

**MGT202 Organizational Behavior [조직행동]**

Organizational behavior is about the study and application of knowledge about how individual or group of people acts within organization. This course introduces the basic concepts, theories, models, and cases of behavioral phenomena such as personality, learning, motivation, group process, leadership, organization design and culture, and organizational change.

**MGT203 International Business [국제경영]**

Companies compete in the international markets with the globalized of world economy. This course in International Business enables students to be equipped with the ability to analyze global issues in economics and to cope well with the rapidly changing international business environment. With the combination of theories and realistic international business cases, students are prepared to understand and deal effectively with the international business issues.

**MGT204 Marketing Management [마케팅 관리]**

This course is an introduction to the theory and application of contemporary marketing. Marketing topics covered include customer needs, company skills, competition, collaborators, and context in marketing and product development (5Cs) and product, price, place, and, promotion (4Ps). The course combines cases, discussions, and theories to provide a mix of integrating concepts and hands-on problem solving.

### MGT205 Financial Accounting [재무회계]
Financial Accounting examines basic concepts of accounting and provides a basic framework to understand the financial statement in users' point of view. This course also provides overview of basic financial statements such as balance sheets, income statement and cash flow statement for financial and accounting decision making.

### MGT206 Managerial Accounting [관리회계]
This course covers the basic concepts and foundations for the management decision-making using accounting information and cost and benefit analysis. The topics include cost structure and cost concepts, strategic decision making, design of various costing systems, and performance measurement systems.

### MGT207 Financial Management [재무관리]
This course introduces various issues in financial management. It provides the student with an introduction to the problems faced by corporate financial managers and investment bankers, and suggests methods for resolving the financial problems including capital structure and capital budgeting problems.

### MGT209 Operations Management [생산운영관리]
Operations management is basically concerned with the production of quality goods and services, and how to make efficient and effective business operations. It involves subjects in the analysis of production planning, inventory and quality control, cost and performance analysis, and supply chain management.

### MGT210 Data analysis & Decision Making [경영통계분석]
The main goal of this course is to understand statistical analysis of data and to apply to various management issues in forecasting and planning. The topics include the basic concept of probability and statistics with the application of practical cases.

### MGT211 Microeconomics [미시경제학]
Microeconomics is concerned with the behaviors of individual consumers and businesses. This course provides an introduction to the analytical tools to understand how individuals and societies deal with the fundamental economic problem of scarcity. This course also provides discussions in applied fields such as environment economics, international trade, industrial organization, labor economics, and public finance.

### MGT302 Human Resource Management [인사관리]
The purpose of this course is to provide undergraduate learners with a basic understanding of the concept, principles and techniques of human resource management. Content to be explored includes, but is not limited to, human resource planning and strategy, staffing (recruiting and selection), training, performance appraisal, compensation, employee relations, diversity, legal issues and contemporary issues.



### MGT303 Strategic Human Resource Management [전략적 인적자원 관리]
This course is designed to understand how companies can strategically manage human resources as a source of competitive advantage. This calls for a departure from a traditional view of HR as an administrative function to a view of HR as a strategic partner. Throughout this course, students will be able to apply the knowledge about strategic management to the functions and roles of human resource management. By integrating organizational strategy and HR practices, students can learn how the system of human resource management can be designed and implemented with the clear goal of contributing to the formulation and implementation of the organization's competitive strategy.

### MGT304 Diversity Management [인력 다양성 관리]
This course takes a multidisciplinary approach to the challenges encountered by individuals, groups, managers and organizations as they strive to deal with an increasingly diverse workforce. It aims to develop students'understanding and critical awareness of issues associated with managing a workforce characterized by diversity in age, gender, race, religion, disability, and sexual orientation. It will explore issues both conceptually and experientially and focus on problem solving so that students will improve their ability as a future employee or manager to address diversity issues in organizations.

### MGT306 Business Ethics [기업경영윤리]
This course examines business ethics from both an organizational and managerial perspective. Students will examine the goal of business organizations, as well as individual conduct in business settings. Ethical reasoning and ethical leadership will guide students through debates on various topics such as: creating an ethical climate in an organization, honesty, affirmative action, environmental ethics, ethics in advertising and sales, financial management, personnel management, and the role of character and virtues in effective leadership.

### MGT307 Legal Environment of Business [경영과 법률 환경]
The legal environment represents a significant segment of the decision-maker's landscape. This course provides an overview of laws and regulations as they pertain to the business atmosphere. Key topics include forms of business enterprise, international law, contracts, intellectual property, and financial reporting and disclosure regulations. Case analysis and ethical implications are discussed in each area.

### MGT308 Strategic Management [경영전략]
This course introduces the basic concepts, process, and various skills and techniques of strategy formulation, implementation and evaluation. Practical cases of Korean and American corporations will be analyzed and discussed.

### MGT312 Macroeconomics [거시경제학]
Macroeconomics is concerned with economic aggregates such as GDP, inflation and unemployment. This course provides an overview of macroeconomic issues such as the determination of output, employment, interest rates, and inflation. Policy issues and applications of basic models will be discussed with special reference to monetary and fiscal policy.

### MGT315 Econometrics [계량경제학]
This course focuses on the application of statistical methods to the testing and estimation of economic relationships. After developing the theoretical constructs of classical least squares, students will learn how to treat common problems encountered when applying the ordinary least squares approach, including serial correlation, heteroscedasticity and multicollinearity.

### MGT317 International Economics [국제경제학]
This course discusses topics in International Trade and International Macroeconomics. Theoretical analyses will be presented in lecture as a basis for discussions on various policy issues. The topics will include patterns of international trade and production; gains from trade; tariffs and other impediments to trade; foreign exchange markets; exchange rate determination theories; balance of payments; capital flows; financial crises; monetary/fiscal policy coordination in a global economy.

### MGT330 Consumer Behaviors [소비자행동]
This course deals with issues related to the purchase and consumption by consumers, and how marketing managers make effective decisions using this information. It also focuses on understanding and predicting consumer behavior based on theories of consumer psychology and cognitive theory.

### MGT331 International Marketing [국제마케팅]
This course introduces basic concepts and theories of marketing management of international business. It focuses on international marketing environment and opportunities, global marketing strategy, and overcoming the barriers in different economic environments.

### MGT332 Brand Management [브랜드관리론]
The goal of this course is to understand how to create a comprehensive brand architecture that will provide strategic direction and develop brand building programs. Relevant theories, models, and tools for the making of brand decisions will be discussed.

### MGT361 Technology Management [기술경영]
This course provides a strategic framework for managing technologies in businesses. As a basis, this course focuses on how technologies, technological structures, and systems affect organizations and the behaviors of their members. Then, this course aims to help students understand the complex co-evolution of technological innovation and identify new opportunities, business ecosystems, and decision-making execution within the business.

### MGT362 Process & Quality Management [생산과 품질관리]
This course covers the approaches in quality improvement and implications in management responsibilities. Practical cases involving business processes will be analyzed and discussed in class.



### MGT363 Operations Research [계량경영학]
This course is an introduction to the key aspects of operations research methodology. Students will model and solve a variety of problems using deterministic and stochastic operations research techniques. Topics include basic theory, modeling, the use of computer tools, and interpreting results.

### MGT364 Database [데이터베이스]
This course deals with the fundamental concepts of current database systems. Specific topics will include data modeling, database system architecture, and query processing. The course also covers advanced issues such as concurrency controls and disaster recovery methods.

### MGT366 Advanced Business Programming [고급 경영 프로그래밍]
This subject examines the principles, techniques and methodologies for the design of business software systems using visual programming tools and the object-oriented approach. This subject describes the concepts of inheritance, encapsulation, construction, access control and overloading. Students will be provided with both the framework and the building blocks with which they can define and implement objects of their own and use them in conjunction with a visual programming system.

### MGT372 Internet Business and Marketing [인터넷 비지니스]
This course intends to introduce students to the concept and practice of e-business. The principal topics include the internet and mobile e-business, e-business models, architecture of web systems, and communications and networking.

### MGT373 Strategic Management of IT [정보기술과 경영전략]
This course will focus on exploring and articulating the framework and methodology associated with the deployment of Information Technology to help formulate and execute business strategy.

### MGT410 Special Topics in MGT I [MGT 특론 I]
This course is designed to discuss contemporary topics in General Management. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MGT411 Special Topics in MGT II [MGT 특론 II]
This course is designed to discuss contemporary topics in General Management. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MGT412 Special Topics in MGT III [MGT 특론 III]
This course is designed to discuss contemporary topics in General Management. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MGT413 Game Theory [게임이론]
Game theory studies an analytical approach to the study of strategic interaction. Students will learn the development of basic theory, including topics such as the Nash equilibrium, repeated games, credibility, and mixed strategies. Applications will include markets and competition, auction design, voting, and bargaining.

### MGT414 Special Topics in MGT IV [MGT 특론 IV ]
This course is designed to discuss contemporary topics in General Management. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MGT432 Marketing Research [마케팅조사론]
This course offers a study of the application of scientific methods to the definition and solution of marketing problems with attention to research design, sampling theory, methods of data collection and the use of statistical techniques in the data analysis. It concerns the use of marketing research as an aid in making marketing decisions. In particular, this course addresses how the information used to make marketing decisions is gathered and analyzed. Accordingly, this course is appropriate for both prospective users of research results and prospective marketing researchers.

### MGT433 Advertising Management [광고관리론]
An analysis of marketing communications from business, social, economic, and political perspectives, this course provides an in-depth discussion of advertising and promotion as key tools in marketing new and established products. This course examines advertising planning and management, research, creative development, media selection, direct response, and advertising agencies. Emphasis is on new media

### MGT441 Global Business Strategy [글로벌경영전략]
This course provides a theoretical framework for strategic management to gain sustainable competitive advantage over rivals for a long period. Using various business cases of multinational companies, this course allows students to obtain strategic mind and capabilities for strategic analysis that can readily be applicable to real international business.

### MGT463 Simulation [시뮬레이션]
This course deals with phenomena that are of a stochastic (rather than deterministic) nature: that is, some aspects of the system under study are subject to random variations. Systems with a stochastic component include a wide range of applications such as inventory, reliability, computer, communication, production, and transportation systems. This course provides a unified approach to the modeling, analysis and simulation of stochastic systems. Analytical tools include the Poisson process, Markov chains and queueing theory. In parallel to the mathematical models, we develop the concept of discrete event simulation.

### MGT464 Stochastic Modeling & Applications [추계적 모델링 및 응용]
This course aims to help students understand the nature of stochastic systems and learn how to model and analyze such systems. The emphasis is on problem formulation, modeling techniques, and realistic applications. The majority of the class will focus on Markov models in discrete time.

### MGT465 System Analysis and Design [경영정보 시스템분석 및 설계]
This course is designed to explore the functions and methods of information systems development from both a practical and theoretical perspective. Upon successful completion of the course, students should be able to analyze and design information systems in a real-world setting and to compare and choose intelligently from among methods, tools, and techniques of systems analysis and design.

### MGT471 Managing Innovation and Change [혁신과 변화의 관리]
This course covers current issues and theories on the management of innovation and change in new and existing organizations. It introduces various perspectives that can help to explore how organizations emerge, innovate, adapt, and fail during the changes in their organizational environments. It prepares students to understand practical business cases and discuss the questions including: How do technical, market, and institutional changes offer opportunities and challenges to incumbent organizations? What are the major obstacles in change management and adaptation? How does ‘a gale of creative destruction’ present opportunities to entrepreneurs?

### MGT473 Entrepreneurship and Venture Management [창업과 벤처]
This course is designed to help students understand the challenges and learn how to approach the process of creating and managing a new venture, which includes recognizing and analyzing an opportunity, mobilizing resources, financing a new venture, and managing growth. To achieve this goal, the course will introduce important concepts and cover a number of cases involving different entrepreneurial challenges and settings. It also serves as the capstone course for those pursing a degree in business management and entrepreneurship.

### MGT474 Social Entrepreneurship [사회적 기업의 창업]
Social entrepreneurs combine the knowledge and skills used in traditional business, with a passionate commitment to having a meaningful and sustainable social impact. Rather thanthe relentless and selfish pursuit of personal enrichment through profit, social entrepreneurs apply their passion and skill to enrich the lives of people who are poor, sick or disenfranchised. The best social entrepreneurs find creative ways to help the disadvantaged help themselves, by building innovative and sustainable new —social enterprises that can be scaled to achieve significant social change.

### MGT490 Interdisciplinary Project [창의시스템 구현]
This course is joined with other tracks for performing a term project through collaboration. Students are required to conceive a novel idea, which will be envisioned by designing and fabricating a product by using the best knowledge learned at an undergraduate level. Lastly, students will present their work in public for evaluation.

### MGT491 Independent Study [개별연구]

This course is intended for students who wish to pursue a discipline in greater depth than possible through the regular curriculum. The course is designed to provide the student with an opportunity to expand current knowledge, develop or enhance necessary skills in a specific area of interest related to management.

### MGT492 Capstone Projects I [캡스톤 디자인 I]

This capstone course offers each student the opportunity to develop a special project in his or her specific area of interest. This includes researching the topic, identifying an issue, developing a strategy and a workplan, establishing a timeline, and implementation of the work schedule. Students will also develop a plan for evaluation.

### MGT493 Capstone Projects II [캡스톤 디자인 II ]

This capstone course offers each student the opportunity to develop a special project in his or her specific area of interest. This includes researching the topic, identifying an issue, developing a strategy and a workplan, establishing a timeline, and implementation of the work schedule. Students will also develop a plan for evaluation.

## □ Finance & Accounting (FIA)

### FIA301 Investments [투자론]

The course in Investment Analysis introduces the students with conceptual framework in the theory and practice of financial investment decisions. The topics include portfolio theory, Capital Asset Pricing Model, market efficiency, and derivative securities pricing.

### FIA302 Money and Banking [금융시장론]

The purpose of this course is to introduce the basic principles of money, credit, banking and to discuss the application of these principles to the issues of current financial policy. It also involves the practical influences of macroeconomic policy on the real sector of the economy and financial markets.

### FIA303 Futures and Option [선물과 옵션]

This course covers some of the main topics in futures, options and other derivative securities. It provides a working knowledge of how derivatives are analyzed, and covers the financial derivative markets, trading strategies and valuation issues involving options and futures/forwards.

### FIA304 International Finance [국제재무관리]

This course deals with the financial issues of corporations and financial institutions in international markets. It covers foreign exchange markets, international stock and bond markets and other related issues in risk and returns.



### FIA305 Corporate Finance [기업재무론]

This course is an elective course for students taking finance/accounting department in School of Business Administration. We will initially focus on the institutional features of corporate financing and governance. Then, course deals with the theory of corporate financing such as capital budgeting and capital structure under perfect market conditions. After establishing this basic framework, we will incorporate various market imperfections, such as, taxes, bankruptcy costs, agency costs, and asymmetric information, into the analysis. The course “Financial management” is a prerequisite for students who are taking this course on advanced financial management contents. This course aims at understanding market efficiency hypothesis, capital structure, dividend policy and working capital management, which are based on fundamental financial theories including the present value model, capital budgeting, portfolio theory, CAPM and cost of capital. Moreover, this course will provide a simple introduction to corporate financial analysis, financial planning and derivatives.

### FIA321 Intermediate Accounting I [중급회계1]

This course is an intensive study of the theories and practices of financial accounting. The primary goal of this course is to understand both current accounting standards and the conceptual framework that is the foundation of current accounting standards. Specifically, this course is designed to acquaint the student with current accounting theories and practices.

### FIA322 Intermediate Accounting II [중급회계2]

While this course is similar to the Intermediate Accounting I course, its topics are more specific and complicated. It focuses on accounting for assets and liabilities, accounting standard processes and economic influence of accounting standards on stockholders.

### FIA331 Introduction to Financial Engineering [금융공학개론]

Financial Engineering is a cross-disciplinary field which covers mathematical and computational finance, statistics, and numerical methods that are useful for trading, hedging and investment decisions, as well as facilitating the risk management of those decisions.

### FIA332 Quantitative Finance [계량재무론]

This course introduces asset price models for explaining stochastic behavior of financial market prices such as equities, currencies, commodities, interest rates, and credits. This course covers what the fair prices of financial derivatives are and how to determine them by using mathematical methods, and also discusses major computational methods that are usually used in financial derivatives valuation. This course focuses on derivation of the Black-Scholes partial differential equation, and validation of various exotic option price with computer simulation with MATLAB.

### FIA402 Fixed Income Securities [채권투자]

This course is designed to introduce fixed income markets including money markets and bond markets. Students are going to understand the time value of money and the relation between price and yield of the bond. The derivatives products underlain by money or bond such as swaps or options will be introduced as well. Most of explanations will be applied to practical market situations.

### FIA404 Risk Management [리스크 관리]

This course is designed to study effective ways of managing financial risks from the perspective of corporations and financial institutions. Major topics include ALM (Asset liability management), VaR, interest rate risk management, credit risk management, and exchange risk management. Other topics include practical cases and statistical tools for risk manage- ment. Finally, this course deals with theories and recent advances in structured products, interest and credit-related derivatives as a tool for risk management. Students are required to have a solid understanding of basics of futures, options and swaps.

### FIA405 Corporate Valuation [기업가치 평가]

This course is an elective course for students taking finance/accounting department in School of Business Administration. This course will expose students to the primary equity research, analysis, and valuation techniques utilized by investment professionals. This course will cover several approaches to corporate valuation: discounted cash flow (DCF) valuation, relative valuation, contingent valuation. Security valuation could be best learned by doing  valuation on his/her own with securities that are traded on the market. Thus, each student will carry out a term project which requires him/her to apply all types of valuation approach they learn during classes with team members.

### FIA410 Special Topics in Finance I [Finance 특론 I]

This course is designed to discuss contemporary topics in accounting. Actual topics and cases will be selected by the instructor and may vary from term to term.

### FIA411 Special Topics in Finance II [Finance 특론 II]

This course is designed to discuss contemporary topics in accounting. Actual topics and cases will be selected by the instructor and may vary from term to term.

### FIA412 Special Topics in Accounting I [Accounting 특론 I]

This course is designed to discuss contemporary topics in accounting. Actual topics and cases will be selected by the instructor and may vary from term to term.

### FIA413 Special Topics in Accounting II [Accounting 특론 II]

This course is designed to discuss contemporary topics in accounting. Actual topics and cases will be selected by the instructor and may vary from term to term.



### FIA414 Applied Investment Management [투자실무]

This course is intended to provide students with working knowledge of applied investment management. Main topics include deciding on the optimal allocation problems, identifying multiple risk factors, assessing the performance, and quantifying the expected return and risk properties of investment opportunities. The course begins by how traditional optimal allocation problems should be modified under real situations such as short shale constraints, differences in lending and borrowing rates, or imposing maximum allocations on particular asset classes. This course also covers topics of investment in commodities and global equities for creating more diversified portfolios. The focus then turns to portfolio strategies and assesments. Portfolio strategies may include portable alpha and futures overlay strategy. The problems addressed are those of the managers of mutual funds, endowments, mutual funds, index funds, exchange-traded-funds (ETFs), and hedge funds.

### FIA415 Mergers and Acquisitions [기업 인수합병론]

The course focuses on corporate governance and merger and acquisition. The corporate form, in contrast to other business form, frequently involves the separation of ownership and control of the assets of the business. The separation result in a number of conflicts of interest between managers and shareholders. In order to mitigate such conflicts of interest, corporate governance structure have been developed and implemented in corporations. This course will explore issues associated with corporate governance such as principal-agency relationship, board of directors, effective corporate governance, elements of a company's statement of corporate governance polices that investment analysts should assess, and the valuation implication of corporate governance.  Merger adds value only if the two companies are worth more together than apart. The merger and acquisition part of this course covers why two companies could be worth more together and how to get the merge deal done.  The specific topics include motivation behind M&A, various valuation methods for target company, post-merger value, the effect of price and payment method, the distribution of benefits in a merger

### FIA416 Corporate Governance [기업 지배구조론]

Since the major corporate frauds in early 2000s, the need for better corporate governance practice becomes stronger. This course deals with the concepts and applications of corporate governance. The course contents include conflicts between principals and agents, incentive mechanism to alleviate it, various mechanisms to implement/supplement corporate governance (e.g., regulations, board of directors, institutional investors, analysts, and product market competition), interactions among different governance mechanisms, and potential conflict of interest among various stakeholders (e.g., creditors vs shareholders). In addition to lectures, students are required to participate in In-class discussion based on case studies and news articles.

### FIA417 Financial Markets and Trading [증권시장론]

This course is an introductory level of market microstructure. Market microstructure is a sub-field of finance that is the study of trading mechanisms. Because most trading occurs during trading session and the market procedure and rules matter, this course deals with the trading protocols and the economic principle that shape them.  Topics include how information is impouded in prices, avoidance of market failures, understanding

market participants and the trading environment, market impact, market fragmentation and consolidation, high frequency trading, algorithm trading, exchanges. dark pools, ATS (Alternative Trading System), ECN (Electronic Communication Network) and regulations on the financial markets. Finally, this course also covers financial market regulations.

### FIA418 Venture Finance [벤처파이낸스]
This course is how to finance and manage privately-held firms. Topics include private firm valuation issues, financing sources and methods, venture and private equity markets, and exit and outcomes for entrepreneurial and privately-held firms.

### FIA431 Financial Time-series Analysis [금융시계열분석]
This course provides a basic introduction to modern time series analysis. This course begin by covering characteristics of financial time series data, fundamental foundations of time series and then discuss their estimation and use for forecasting. Topics include stationarity vs non-stationarity, AR/MA/ARIMA, and ACF/PACF. We also cover some multivariate time series models such as vector autoregressive models (VAR) and volatility models such as ARCH/GARCH. Finally, we also discuss potential time series issues in financial economics;, for e.g., Granger causality, cointegration problems, etc.

### FIA441 Financial Statement Analysis [재무제표분석]
The goal of this course is to develop skills essential to using financial information and accounting statements for capital market decisions. The course is designed to prepare students to interpret and analyze financial statements.

### FIA442 Taxation [세무회계]
This course is designed to introduce basic concepts and theories of tax accounting. The course will focus primarily on corporate income tax laws and regulations and related corporate tax accounting issues. Other tax issues that corporations are facing in their tax accounting will be discussed as well in the class.

### FIA443 Cost Accounting [원가관리 전략]
Explores critical issues facing accounting and financial managers in the current
business environment. Topics include: introduction to state-of-the-art managerial accounting practices, in-depth understanding of cost management, product and service costing methods, performance evaluation and managerial compensation systems. Global and ethical issues are examined. Written assignments, case studies and team discussions comprise much of classroom interaction.

### FIA445 Auditing [감사학 개론]
This course is designed to introduce basic concepts of financial audits, generally accepted auditing standards, key audit procedures and audit techniques. This course also covers audit quality, auditors' responsibilities, and other hot issues including regulatory systems over the audit profession.



### FIA490 Interdisciplinary Project [창의시스템구현]
This course is joined with other track for performing a term project through collaboration. Students are required to conceive a novel idea, which will be envisioned by designing and fabricating a product by using the best knowledge learned at an undergraduate level. Lastly, students will present their work in public for evaluation.

### FIA492 Capstone Projects I [캡스톤 디자인 I]
This capstone course offers each student the opportunity to develop a special project in his or her specific area of interest. This includes researching the topic, identifying an issue, developing a strategy and a workplan, establishing a timeline, and implementation of the work schedule. Students will also develop a plan for evaluation.

### FIA493 Capstone Projects II [캡스톤 디자인 II]
This capstone course offers each student the opportunity to develop a special project in his or her specific area of interest. This includes researching the topic, identifying an issue, developing a strategy and a workplan, establishing a timeline, and implementation of the work schedule. Students will also develop a plan for evaluation.

# School of Management Engineering

## 1. School Introduction

UNIST School of Management Engineering provides education at the crossroads of engineering and management. Management engineering concerns the application of scientific analysis methods for efficient and effective decision making in industrial and operations management. In this context, the School of Management Engineering at UNIST aims at developing talented people who combine both engineering and management knowledge, and who will lead the national industry and economy based on active and self-directed leadership, strongly built on problem solving ability. Under the vision of "Data-Driven Convergence," the School of Management Engineering at UNIST focuses on quantitative data analysis techniques, such as statistics, optimization, data mining, technology innovation management, process management and enterprise systems, and financial engineering.

## 2. Undergraduate Programs

### □ Track Introduction

#### 1) Management Engineering (MGE)

Management engineering is a branch of engineering which deals with the data analytics and optimization of complex processes, systems, or organizations to solve specific problems in industry and management. The School of Management Engineering (SME) in UNIST provides the following curriculum for undergraduate students. In the UNIST SME, the student can become a data scientist who can solve problems with data and cultivate capability to be a leader in industry or academia.

### □ Credit Requirement

| Track | Required/Elective | Credit (minimum) | | Remark |
|---|---|---|---|---|
| | | Interdisciplinary Major | | |
| | | 1st Track | 2nd Track | |
| MGE | Required | 24 | 9 | |
| | Elective | 30 | 9 | |



### □ Fundamental Course for MGE track

▶ Required Mathematics Course for MGE Track

| Track | Course No. | Required Mathematics Course | Remarks |
|---|---|---|---|
| MGE | MTH203 | Applied Linear Algebra | |
| | MTH211 | Statistics | |

※ Complete based on 1TR

▶ Fundamental required by another School students when they choose School of Management Engineering track as 2nd Track

| Track | Course No. | Required Mathematics Course | Remarks |
|---|---|---|---|
| MGE | MTH211 | Statistics | |

### □ Required Experimental Course

| Track | Required Course |
|---|---|
| MGE | MGE450 Project Lab. |

※ Complete based on 1TR

## 3. Curriculum

※ Course opening semester is subject to change according to School's situation.

### □ Management Engineering (MGE)

▶ Required

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGE | MGE201 | Operations Research Ⅰ<br>계량경영학 Ⅰ | 3-3-0 | | 2 |
| | MGE205 | Investment Science<br>계량투자론 | 3-3-0 | | 2 |
| | MGE206 | Introduction to Industrial & Management Engineering<br>산업경영공학의 이해 | 3-3-0 | | 1 |
| | MGE207 | Data Science Programming<br>데이터 사이언스 프로그래밍 | 3-3-0 | | 2 |

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGE | MGE209 | Operations Management<br>생산운영관리 | 3-3-0 | | 1 |
| | MGE303 | Data Mining<br>데이터 마이닝 | 3-3-0 | | 1 |
| | MGE305 | Operations Research Ⅱ<br>계량경영학 Ⅱ | 3-3-0 | Prerequisite:<br>MGE201, MGE209 | 1 |
| | MGE313 | Time-series Analysis<br>시계열 분석 | 3-3-0 | Prerequisite: MTH211 | 2 |
| | MGE404 | Data-driven Process Management<br>데이터 기반 프로세스 관리 | 3-3-0 | | 2 |
| | MGE406 | Applied Machine Learning<br>기계학습 응용 | 3-3-0 | Prerequisite: MGE303, MTH211 | 1 |
| | MGE450 | Project Lab.<br>프로젝트 랩 | 3-1-4 | | 1 |
| **Total Credit** | | | **33** | | |

▶ Elective

| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| MGE | MGE308 | Service Simulation<br>서비스 시뮬레이션 | 3-3-0 | Prerequisite: MGE209 | 2 |
| | MGE361 | Quantitative Technology Management<br>계량기술경영 | 3-3-0 | | 2 |
| | MGE362 | Statistical Quality Management*<br>통계적 품질관리 | 3-3-0 | | 1 |
| | MGE412 | Advanced Investment Science<br>고급계량투자론 | 3-3-0 | Prerequisite: MGE205 | - |
| | MGE421 | Blockchain Systems<br>블록체인 시스템 | 3-3-0 | | 1 |
| | MGE422 | Social Network Analysis<br>사회 연결망 분석 | 3-3-0 | Prerequisite: MGE303 | 2 |
| | MGE470 | Special Topics in MGE Ⅰ<br>MGE 특론 Ⅰ | 3-3-0 | | |
| | MGE471 | Special Topics in MGE Ⅱ<br>MGE 특론 Ⅱ | 3-3-0 | | |
| | MGE472 | Special Topics in MGE Ⅲ<br>MGE 특론 Ⅲ | 3-3-0 | | |
| MAE | MEN301 | Numerical Analysis<br>수치해석 | 3-3-0 | | 2 |



| Track | Course No. | Course Title | Cred.-Lect.-Exp. | Remarks | Semester |
|---|---|---|---|---|---|
| SDC | SDC202 | Computational Tools for Engineers<br>공학전산기법 | 3-3-0 | | 2 |
| | SDC304 | Manufacturing System Design & Simulation<br>생산시스템설계 및 시뮬레이션 | 3-3-0 | | 2 |
| CSE | CSE232 | Discrete Mathematics<br>이산수학 | 3-3-0 | | 1,2 |
| | CSE463 | Machine Learning<br>기계 학습 | 3-3-0 | Prerequisite: EE211, CSE331 | 2 |
| MTH | MTH201 | Differential Equations<br>미분방정식 | 3-3-0 | Prerequisite: MTH111 | 1,2 |
| | MTH251 | Mathematical Analysis Ⅰ<br>해석학 Ⅰ | 3-3-0 | | 1 |
| | MTH321 | Numerical Analysis<br>수치해석학 | 3-3-0 | Prerequisite: MTH201, MTH203 | 2 |
| | MTH333 | Scientific Computing<br>과학계산 | 3-3-0 | | - |
| | MTH342 | Probability<br>확률론 | 3-3-0 | | 2 |
| | MTH361 | Mathematical Modeling and Applications<br>수리모형방법론 | 3-3-0 | Prerequisite: MTH201, MTH203 | 1 |
| | MTH421 | Introduction to Partial Differential Equations<br>편미분방정식개론 | 3-3-0 | Prerequisite: MTH201, MTH203<br>Recommended Course:<br>MTH315, MTH251 | 1 |
| MGT | MGT207 | Financial Management<br>재무관리 | 3-3-0 | | 1,2 |
| | MGT308 | Strategic Management<br>경영전략 | 3-3-0 | | 1 |
| | MGT315 | Econometrics<br>계량경제학 | 3-3-0 | Prerequisite: MTH211 | 1 |
| FIA | FIA332 | Quantitative Finance<br>계량재무론 | 3-3-0 | Prerequisite: MGT207 | 1 |
| | FIA404 | Risk Management<br>리스크관리 | 3-3-0 | Prerequisite: MGT207 | 2 |
| ESE | ESE243 | Science Humanities<br>과학인문학 | 3-3-0 | | - |
| HFE | HFE301 | Experimental Design<br>실험계획법 | 3-3-0 | Prerequisite: MTH211 | 1 |
| **Total Credit** | | | 84 | | |

※ Management Engineering Track Curriculum consists of Required Group and Elective Group. Students are required to fulfill the minimum credit requirements by taking courses from Required Group. Required Group offers 10 Lecture courses and 1 Experimental course (Total 33 credits) which is excessive for the minimum graduation requirement (1st track: 24, 2nd track: 9). The students can choose course from among the Required Group course list based on their individual academic and research interest. It is mandatory to enroll in 1 Experimental course for 1st Track students. If students choose more required courses than the minimum requirements, then the required courses in excess can be counted as elective courses. Vice versa, i.e., using elective courses to fulfill the required courses minimum requirements, is not allowed.

## 4. History of Courses Change of 2019–2020

| Category | 2019 | ⇒ | 2020 |
|---|---|---|---|
| MGE | MGE205 (Required)<br>Introduction to Financial Engineering<br>금융공학개론 | ⇨ | MGE205 (Required)<br>Investment Science<br>계량투자론 |
| | MGE412 (Elective)<br>Quantitative Financial Planning<br>정량적 재무 관리 | ⇨ | MGE412 (Elective)<br>Advanced Investment Science<br>고급계량투자론 |
| | MGE421 (Elective)<br>Blockchain-based System Engineering<br>블록체인 기반 시스템 | ⇨ | MGE421 (Elective)<br>Blockchain Systems<br>블록체인 시스템 |

## 5. Course Descriptions

### □ Management Engineering (MGE)

#### MGE201 Operations Research I [계량경영학 I ]

Operations Research is a quantitative approach to decision making based on the scientific method of problem solving. This course is an introduction to the key aspects of Operations Research methodology. Students will learn how to model and solve a variety of deterministic problems using optimization techniques. Topics will include basic theory, model formulation, solution techniques, and result analysis/interpretation.

#### MGE205 Investment Science [계량투자론]

This course introduces the basic knowledge on various financial instruments as well as quantitative models for finance. The main topics include: equities, fixed-income securities, derivatives including options and futures, asset pricing models, and investment management. In addition, we will learn how to implement basic financial engineering problems using Python.

#### MGE206 Introduction to Industrial & Management Engineering [산업경영공학의 이해]

Management engineering links engineering, science, and management to plan and operate management strategy of corporations. This course will cover a variety of models and methods in the field of management engineering, ranging from qualitative frameworks to quantitative techniques. Students are expected to develop the capability to synthesize engineering technology and management strategy.

#### MGE207 Data Science Programming [데이터 사이언스 프로그래밍]

This courses focuses on Python as a programming language and covers basic and advanced topics related to algorithm design and data management. The first part of the course focuses on fundamental data structures (e.g., stacks, queues, trees, heaps) and algorithms (e.g., recursion, sorting) for programming. In the second part, the course looks at advanced data structures, such as graphs, and advanced aspects related to data acquisition and processing, e.g., natural language and text processing or tracking and processing of live Twitter streams. The objective of the course is to give students the ability to design advanced algorithms for acquiring, storing and processing effectively data regardless of the application domain.

#### MGE209 Operations Management [생산운영관리]

Operations management is basically concerned with the production of quality goods and services, and how to make efficient and effective business operations. It involves subjects in the analysis of production planning, inventory and quality control, cost and performance analysis, and supply chain management.

#### MGE303 Data Mining [데이터마이닝]

Data mining is comprised techniques from statistics, AI, and computer science. It is applied not only to conventional engineering and science problems, but also to various business areas such as manufacturing, marketing and finance. This course introduces basic data mining problems (clustering, classification, and association analysis) and the respective algorithms and techniques. In addition, students will learn about actual business problems, goals, and the environment in which data mining is applied. Cases in various areas will be studied. Students are strongly encouraged to identify and solve real world business problems using data mining techniques so that they improve their relevance to human interface design.

#### MGE305 Operations Research II [계량경영학 II]

Operations Research II is the second part of a two-course sequence of Operations Research that develops/analyzes models commonly used in the analysis of complex decision-making problems. This course will extend the course materials discussed in Operations Research I and will introduce students to several important types of mathematical and stochastic (probabilistic) models and solution techniques, including dynamic programming, stochastic processes, queueing models, inventory control, supply chain management, and revenue management.

#### MGE308 Service Simulation [서비스 시뮬레이션]

Service systems in transportation, retail, healthcare, entertainment, hospitality, and other areas are configurations of people, information, organizations, and technologies that operate together for specific functions and values. The field of Service Science is emerging as the study of complex service systems, and involves methods and theories from a range of disciplines, including operations, industrial engineering, marketing, computer science, psychology, information systems, design, and more. Effective understanding of service systems often requires combining multiple methods to consider how interactions of people, technology, organizations, and information create value under various conditions. In this course, we will learn and apply concepts and methods in Service Science for service management and engineering.

### MGE313 Time-series Analysis [시계열 분석]
This course introduces the basics of modern time series analysis. Students will learn about the characteristics of time series data and the basics of time series regression and exploratory data analysis. Then, we will cover various models and techniques in time series analysis including ARMA/ARIMA models, and state space models. In addition, some additional topics including GARCH models or artificial neural network (ANN) models would be briefly introduced.

### MGE361 Quantitative Technology Management [계량 기술경영]
Technology management is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. This course will cover a variety of topics and quantitative methods in the field of technology management. Students are expected to learn the ways of integrating data science into different types of problems in the field of technology management.

### MGE362 Statistical Quality Management [통계적 품질관리]
The objective of this course is to teach various methods that can be used for improving the quality of products and processes. Topics for this course are quality system requirements, designed experiments, process capability analysis, measurement capability, statistical process control, and acceptance sampling plans.

### MGE404 Data-driven Process Management [데이터 기반 프로세스 관리]
Business processes are ubiquitous in modern organizations and their execution is increasingly supported by advanced information systems, which make available a large amount data related to their design and execution. The first part of this course focuses on the typical phases of business process management in an organisation, that is, business process identification, business process modelling (using BPMN 2.0), and business process analysis and improvement. The second part focuses on process mining, that is, a state of the art technique to extract knowledge about business processes, e.g., process models, from the logs of the IT systems supporting their execution.

### MGE406 Applied Machine Learning [기계학습 응용]
The objectives of this course are (1) to learn about basic and advanced machine learning, including deep learning, (2) to identify various real-world problems for the use of machine learning, and (3) to employ machine learning algorithms for solving the real-world problems in various fields.

### MGE412 Advanced Investment Science [고급계량투자론]
In this course, we will learn about the stochastic process on the continuous time line and the theoretical approaches for finding financial derivatives values. This course will mainly focus on understanding main properties on Brownian motion and the derivative pricing theory with a Black-Scholes_Merton approach and a probabilistic approach. This course will focus mainly on the theory but examines some estimation methods as well empirical evidence.



### MGE421 Blockchain Systems [블록체인 시스템]
This course introduces blockchain technology. The objective of this course is to cover the basics of blockchain technology as a technology for designing and implementing cross-organisational information systems. The course starts with an overview of blockchain technology and its emergence in the field of cryptocurrency and then will focus more extensively on designing systems using blockchain. The course will look both at applications of blockchain in real world scenarios and at the more technical aspects related with the implementation of such systems.

### MGE422 Social Network Analysis [사회 연결망 분석]
This course introduces students to the basic concepts and analysis techniques in (online) social network analysis. After completing this course, students will learn how to (1) analyze large-scale online user-generated data on social networks (e.g., social media, such as Facebook or Twitter) and (2) apply machine learning techniques to discover knowledge from online social networks.

### MGE450 Project Lab. [프로젝트 랩]
The objective of this course is to learn how various course content in the School of Management Engineering (e.g., machine learning/deep learning, data mining, statistics, operations research, financial engineering) can be applied to solve complex real-world problems. Students independently conduct a project that has strong research and practical relevance.

### MGE470 Special Topics in MGE Ⅰ [MGE 특론 Ⅰ]
This course is designed to discuss contemporary topics in Management Engineering. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MGE471 Special Topics in MGE Ⅱ [MGE 특론Ⅱ]
This course is designed to discuss contemporary topics in Management Engineering. Actual topics and cases will be selected by the instructor and may vary from term to term.

### MGE472 Special Topics in MGE Ⅲ [MGE 특론 Ⅲ]
This course is designed to discuss contemporary topics in Management Engineering. Actual topics and cases will be selected by the instructor and may vary from term to term.